UNIVERSITY *of* TASMANIA

Relationship of Dental Practitioners to the Primary Care Network in Rural and Remote Queensland and the Application of Technology in the Management of Dental Problems

by

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Submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

Centre for Rural Health, University of Tasmania

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Declaration of Originality

I, Jacqueline Christine Stuart, am the author of the thesis titled "Relationship of dental practitioners to the primary care network in rural and remote Queensland and the application of technology in the management of dental problems" submitted for the degree of Doctor of Philosophy. I declare that the material is original, and to the best of my knowledge and belief, contains no material previously published or written by another person, except where due acknowledgement is made in the text of the thesis, nor does the thesis contain any material that infringes copyright. The thesis contains no material which has been accepted for a degree or diploma by the University or any other institution.

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Statement regarding lectures resulting from this thesis and the published work.

Presentations

The primary care network participants interviewed for this research project expressed their need for upskilling in emergency dental presentation management techniques and consequently the candidate has developed and presented a series of presentations, in a volunteer capacity, from 2015 to 2018 throughout Queensland and Tasmania. The details of these presentations are as follows;

Date	Title	Organisation and Location	Audience
6-12-2018	Emergency dental presentations to the medical practitioner & their management options.	Mackay General Medical Practitioner Training Program College of Medicine & Dentistry Division of Tropical Health & Medicine James Cook University.	Medical Registrars
2-09-2018	Connecting Oral Health into the overall medical health puzzle	North Queensland Primary Health Network 2018 Conference Mackay	General Medical Practitioners & other Allied Health Care Providers
7-06-2018	A workshop, demonstrating practical emergency dental techniques for the general medical practitioner	The Rural Doctors Association Queensland GMT18 conference for Queensland in association with Dental School at James Cook University in Cairns, Queensland.	General Medical Practitioners

8-06-2018	Emergency dental presentations to the medical practitioner & their management options.	The Rural Doctors Association Queensland GMT18 conference for Queensland in association with Dental School at James Cook University in Cairns, Queensland.	General Medical Practitioners
30-05-2018 31-05-2017 25-05-2106 27-05-2015	Emergency dental techniques for the general medical practitioner & their management options & Oral presentations of medical conditions.	College of Medicine & Dentistry Division of Tropical Health & Medicine James Cook University.	All final year/sixth year medical students at James Cook University
24-01-2018	Emergency dental presentations to the medical practitioner & their management options.	Generalist Medical Training Program in Cairns	Medical Registrars
8-12-2017	Emergency dental presentations to the medical practitioner & their management options.	Generalist Medical Training Program in Toowoomba	Medical Registrars
5-09-2017	Emergency dental presentations to the medical practitioner & their management options.	Generalist Medical Training Program in Mackay. College of Medicine & Dentistry Division of Tropical Health and Medicine James Cook University.	Medical Registrars
9-05-2017 10-05-2017 11-05-2017 16-05-2017 17-05-2017 18-05-2017 30-05-2017	Emergency dental presentations to the [General Medical Practitioner, Pharmacist or Allied Health Care provider] & their management options.	Presentations in Cairns, Townsville & Mackay for the North Queensland Primary Health Network	General Medical Practitioners, Pharmacists & Allied Health Care Providers

31-05-2017 1-06-2017			
29-10-2016	Emergency dental techniques for the general medical practitioner & Oral presentations of medical conditions.	The Medical Practitioners Association Hospital Services Emergency Medicine Workshop in Mackay	General Medical Practitioners
20-07-2016	Emergency dental techniques for the general medical practitioner & Oral presentations of medical conditions.	"Rural Rounds" VCR linkup throughout Northern Queensland on the topics	Queensland Rural General Medical Practitioners
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- Barnett, T., Hoang, H., **Stuart, J.,** &Crocombe, L. (2015). “Non-dental primary care providers' views on challenges in providing oral health services and strategies to improve oral health in Australian rural and remote communities: a qualitative study”, *British Medical Journal Open*, 5, pp. 1-8. Article e009341. doi: 10.1136/bmjopen-2015-009341 ISSN 2044-6055 (2015) [Referred Article] 25:25:**25**:25
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- Hoang, H and Barnett, A and **Stuart, J** and Crocombe, L and Page, S, “Primary care providers’ strategies on how to fix the oral health crisis in the bush”, 6-9 September, 2015, Hobart, Tasmania (2015) [Plenary Presentation] 20:20:**20**:20:20

Other Public Output

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Statement of Co-Authorship

The following people contributed to the publication of the works undertaken and listed as part of this thesis.

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Statement of Ethical Conduct

The research associated with this thesis abides by the international and Australian codes on human and animal experimentation, and the guidelines by the Australian Government's Office of the Gene Technology Regulator and the rulings of the Safety, Ethics and Institutional Biosafety Committees of the University.

This study was approved by the Tasmanian Health and Medical Human Research Ethics Committee [reference number: H0013217].

Approval to interview participants from communities E,F, and G was given by the Director of Medical Services for Central Western Queensland, Dr David Rimmer.

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"Knowledge is in the end based on acknowledgement" Ludwig Wittgenstein

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Abstract

Oral health and access for oral health services for residents in rural and remote Australian communities is often poorer than for those living in capital cities. People who have difficulty in accessing timely oral health care often present to non-dental primary care providers in hospital emergency departments, medical practices, pharmacies and Indigenous health centres for management of dental problems. However, these non-dental primary health care providers may not have the skills to deal with dental issues and can often only provide temporary, palliative relief.

This study examined the extent to which oral health problems impact on service provision by non-dental primary health care providers in eight rural and remote Queensland communities. The study identified the challenges that residents face to timely oral health care access and the strategies most likely to be effective in improving oral health care access for these people. The effects on patient oral health outcomes of interprofessional relationships between the non-dental primary care networks and oral health care practitioners were explored, and the interest in the use of technology by non-dental primary care providers to manage oral health issues is assessed.

Eight Queensland communities were purposively selected as they did not have a resident dental practitioner but had an active non-dental primary care network. Three different models of oral health care delivery service were examined in three descriptive case studies. Semi-structured face to face and telephone interviews were conducted with 12 dental and 55 non-dental primary care providers. The transcribed interviews were analysed using thematic analysis with the assistance of a computer software package Nvivo 10.

This study found that the barriers to effective oral health care access include: (1) dental workforce shortages; (2) the patient costs of accessing oral health care in relation to travel, time off work and the actual cost of the treatment itself; (3) the lack of oral health awareness of residents; (4) poor oral health preventative strategies; (4) poor oral health promotional strategies; and (5) lack of oral health funding. Each of the three examined oral health care service models had challenges which were specific to their situations and strategies to overcome these barriers were explored.

The nature of the relationships between non-oral health care practitioners and oral health care practitioners were generally described as “poor at best” and often “non-existent”. This was attributed in part to high staff turnovers and the transient nature of locum medical practitioners and pharmacists. The siloed behaviours of both the dental and non-dental care providers further contributed to the divide that exists between oral health and medical health,

The interest of both dental and non-dental primary care providers, for the potential of intraoral cameras in medical practice to allow remote diagnosis of dental images by dental practitioners was explored. A number of practicalities were identified such as poor internet speed capabilities, personnel training requirements and the time constraints experienced by rural and remote primary health care providers.

Strategies to improve access to oral health services included: (1) increasing the dental workforce; (2) building the oral health care provision capacity of non-dental primary care providers; (3) providing alternative oral health service delivery models; (4) providing preventative oral health care; and (5) encouraging better interprofessional communication and collaborations between non-dental rural primary care networks and oral health care practitioners.

As the internet and telecommunications networks improve in rural and remote Queensland, further research should be undertaken to re-examine the interest in the applications for teledentistry to improve rural and remote oral health services. Further research could explore patient experiences around the issues of poor access to oral health services, including low socio-economic and Indigenous peoples' oral health access experiences. Revisiting the communities examined in this project into the future, with a study that uses a co-design intervention approach, would be an area for future research. It would also be of value to also explore the effects that the expected surplus of dental graduates towards 2020 might have on oral health in rural and remote Queensland into the future.

Glossary

Comprehensive Oral Health Care: This type of oral health care provides definitive oral health care and includes comprehensive treatment planning, root canal therapies, crown and bridge procedures, implants, orthodontics and denture constructions.

CPD (Continuing Professional Development): Continuing Professional Education Points are a requirement for continuation of registration for medical and dental care providers to ensure competence and maintenance of currency of knowledge.

Dental Assistants: also called dental nurses have the role of preparing patients for dental examinations and of assisting dentists and other dental care providers in providing oral health care to patients.

Dental Hygienists: perform various preventative treatments and to aid in the education and implementation of oral hygiene needs of a patient.

Dental Prosthetists: are qualified dental technicians who are registered with the Dental Board of Australia and have completed further dental studies to enable them to work directly with clients for the construction and maintenance of removal prosthetic appliances or dentures.

Dental Technicians: roles are to make and repair dentures (full and partial) and other dental appliances.

Dental Therapists: work within their scope of practice as dental allied health care providers and provide basic dental treatments to children such as dental check-ups, filling and baby teeth extractions.

Dental Workforce: A workforce providing oral health care which consists of dentists, oral health therapists, dental therapists, dental hygienists, dental technicians and dental assistants.

Dentists: Tertiary qualified dental practitioners who act as the team leader in the dental workforce and provide oral health care services to adults and children. They may pursue further education in specialist areas of dental care.

Dental Personnel: People who work in the oral health care service in either a clinical, assisting or practice managing and organisational role.

Dental Practitioners: dentists and oral health therapists who provide clinical oral health care directly to patients.

Dental Technology: Intraoral cameras utilised in teledentistry which are networked across telecommunication networks.

DON (Director of Nursing): A registered nurse who supervises the care of all the patients at a health care facility. The director of nursing is person responsible for communicating between the nursing staff and the physicians at a health care facility.

DRISS (Dental Relocation Infrastructure Scheme): A government initiative to offer dental practitioners substantial funding grants to establish new practices in rural Australia.

Emergency dental care: This type of dental care consists of emergency intervention for the relief of dental disease symptoms. It may involve temporary restoration, extraction or the removal of the nerve of the tooth. It does not include comprehensive oral health care.

eHealth: refers to the use of communications technologies and information in healthcare.

Fluoride: A naturally occurring element found in existing water supplies. Fluoride helps prevent tooth decay by making the tooth more resistant to acid attacks from plaque bacteria as also reversing early decay. Fluoridation of town water supplies is recognised world-wide as the safest preventative oral health care strategy.

Indigenous oral health care services: Provide oral health care to Aboriginal and Torres Strait Islander peoples.

Intraoral cameras: Small networkable cameras that are placed inside the mouth of a patient to take still or video images of teeth and oral tissues.

Medicare: Australia's universal health care system where all Australians contribute to the cost of health care according to their incomes via income tax and a Medicare levy. Dentistry is generally not covered under Medicare although some rare exceptions do exist, such as for cleft palate surgery and certain government funded schemes.

NBN (National Broad Band Network): A national telecommunications infrastructure project designed to meet the rapidly expanding demand for internet access across the whole of Australia replacing the existing telephone network copper cables which are nearly worn out.

ND-RPCN (Non-Dental Rural Primary Care Network): A network of non-dental primary care health care providers who provide health care to rural and remote residents. The members of each network may vary, with some specialist practitioners flying in and flying out as required. The ND-RPCN may consist of General Medical Practitioners, Pharmacists, Directors of Nursing (DONs), Nurse Unit Managers (NUMs), general nurses, women's health nurses, speech pathologists, child and community health nurses, mental health nurses and Indigenous health workers. The members of each network may vary, with some specialist practitioners flying in and flying out as required.

NGO-Mobile Dental Service/ NGO MDS (Non-government organisation Mobile Dental Service): A philanthropic mobile dental service, jointly funded by a Queensland private mining company and a non-government organisation. It provides dental services to selected Queensland communities that have limited access to oral health care facilities.

NUM (Nurse Unit Manager): Refers to a registered nurse at managerial level who has completed formal nursing training and is responsible for coordinating patient services and supervising the staff in the hospital.

OHTGYP (Oral Health Therapist Graduate Year Program): The OHTGYP provided oral health therapist graduates with a structured programme for enhanced practice experience via public sector placements in areas of need, such as rural and regional locations. The program ended in 2015.

Oral Health Care Practitioners (Dental Auxiliaries): Those other oral health care providers who are not dentists which include: dental hygienists, dental therapists, oral health therapists, dental technicians and dental assistants.

Oral Health Therapists: Tertiary qualified personnel who are limited to the practice of dental hygiene, dental therapy on children and oral health promotion with education in both private and public forums.

Preventative dental care: This type of care may prevent the development of oral disease. It consists of dental promotion, education, oral hygiene instruction, prophylactic tooth cleaning and fluoride provision.

Private dental care: Most of Australia's dental services (85%) are provided by the private dental practitioners who require fees for their service.

Public/government dental care: Free government oral health services are only provided for children up to 18 years of age and for adults with health care concession cards.

Root canal therapy: This is a dental procedure that removes the infected pulp (nerve) of the tooth and fills the tooth with an inert medicament that allows tooth retention rather than extraction.

Rural multi-purpose health services: Rural multi-purpose health services provide 24 hour emergency, inpatient services and aged care services in medium-sized towns.

Teledentistry: the transmission of intraoral images across telecommunication pathways to remotely located dental practitioners for diagnosis of dental conditions.

Telehealth: is recognised way to provide medical care to distant communities. Telemedicine combines digital technologies, the internet and telecommunications to provide remote healthcare access to rural areas.

Teleconferencing: The conducting of meetings/treatment planning sessions/post graduate education across the internet via video links.

VGDYP (Voluntary Graduate Dental Year Program): The VDGYP provided dental graduates with a structured programme for enhanced practice experience and professional development opportunities by placements in rural and remote locations. The Programme commenced on 1 January 2013 and ended at the end of 2015.

Chapter One: Introduction

"The art and science of asking questions is the source of all knowledge"

Thomas Berger (American novelist born 1924 and died 2014).

The World Health Organization defines good oral health as "a state of being free from chronic mouth and facial pain, oral and throat cancer, oral sores, birth defects such as cleft lip and palate, periodontal (gum) disease, tooth decay and tooth loss, and other diseases and disorders that affect the oral cavity" (Petersen, 2003, p. 3). An affluent country such as Australia, should have good oral health as an attainable goal for its citizens regardless of their location or socioeconomic status. However, Australian rural and remote residents have poorer oral health and overall health outcomes and poorer access to health care services than residents in major cities. This study describes strategies perceived by primary and dental care practitioners to improve the provision of oral health services to rural and remote communities in Queensland. The findings are predicted to influence current medical training and practice, which will ultimately benefit people living in rural and remote Australia experiencing oral health issues in the absence of a resident dentist. The study will provide information for policy makers, funding bodies and government departments to enable better understanding the importance of effective and timely dental interventions, by dental and/or medical practitioners, in reducing preventable hospitalisations for conditions of dental origin.

This research project aimed to contribute to original research in several ways. The first was to investigate the extent to which oral health problems impact on service provision by primary health care providers, and the barriers that exist for effective oral health care provision to people in the communities studied. Another contribution was to identify what interventions and strategies were most likely to be effective in improving oral health in these communities. The nature of interprofessional communications between dental and non-dental health care providers was examined for the effects that this collaboration or lack thereof has on patient outcomes. Another contribution made by this research project to original research was to assess the interest of dental practitioners and non-dental primary care networks in rural and remote Queensland in the introduction of dental technologies to medical practice in order to improve the management of dental conditions.

This introductory chapter presents an overview of the study beginning with a background outlining the research and contextual information, which formed the foundation and rationale of the study. It

then states the research aim and objectives. This is then followed by an overview of the methodology and the structure of the thesis.

1.1 Background and rationale of the study

Australian residents living in major cities make up 69% of the total population. Only 20% of Australians live in inner regional areas, 9% live in rural areas, 1.5% live in remote areas and 0.8% live in very remote areas (Australian Bureau of Statistics, 2016).

Australia's recent National Oral Health Plan 2015-2024 (Oral Health Monitoring Group, 2015) recognised rural and remote residents as being a group within the population who experience poorer oral health than other Australian people. Inhabitants in these regions have poorer overall health outcomes and access to health care services than residents in major cities (Australian Bureau of Statistics, 2013b). Twenty-eight percent of adults who live outside capital cities visit the dentist usually only for acute dental emergencies, rather than for regular preventative care or check-ups (Australian Research Centre for Population Oral Health, 2014). They also have a greater risk of poorer oral health outcomes (National Advisory Council on Dental Health, 2012) and higher rates of dental caries, than people who live in cities (Slade et al., 2007). Rural residents present to dental practitioners with dental emergencies more often than residents of major cities (Brennan & Ellershaw, 2012). There are a myriad of influences that contribute to this situation, but dental service provision and access to dental services are key factors.

Towns in many rural and remote areas in Australia are often widely dispersed and lack the population base to warrant a full-time dentist and so visiting mobile dental facilities or intermittent "fly-in fly-out" dental services are often used to try to meet the oral health needs of rural and remote residents (Walker et al., 2013). Alternatively, residents may often access oral health care by travelling large distances (often hundreds of kilometres) to centrally located dental practitioners in larger communities. The oral health care that these rural and remote residents seek is often irregular due to the costs associated with travel such as: cost of fuel, time off work and away from the responsibilities associated with caring for dependents, as well as the high costs of dental fees for those without health insurance cover (Curtis et al., 2007).

Rural communities are generally served by a range of non-dental health care professionals: the "primary health care network". In the absence of a resident dental practitioner, patients with a dental problem may present to the primary health care network located in general medical practices (Cohen et al., 2011), hospital emergency departments (Cohen et al., 2011; Cohen et al., 2008; Lee et al., 2012), pharmacies (Maunder & Landes, 2005) or Indigenous Health Centres (Kruger, Perera, et

al., 2010; Tennant & Kruger, 2014). Non-dental primary care providers are usually able to provide only temporary relief of symptoms and referral rather than definitive treatment (Barnett et al., 2014; Cohen et al., 2011; Maunder & Landes, 2005). Dental presentations to an emergency hospital department may result in admission for treatment. Between 2015- 2016, there were 67,266 potentially preventable hospitalisations for medical conditions from dental origins in Australia, the third highest reason for acute preventable hospital admissions in Australia. These admission rates were higher in rural areas and highest for remote and very remote areas (Australian Institute of Health and Welfare, 2016; Falster & Jorm, 2017). Without timely preventive dental care in rural settings, the concern is that people in these communities may have been hospitalised due to potentially avoidable dental conditions. Consequently, there are strong imperatives to investigate ways in which these communities can be provided with better oral health services in realistic and cost effective ways.

Practitioners in the primary health care network often work in extended capacities because of workforce shortages and such practitioners provide an important network of heath care professionals serving rural and remote communities. Stronger links and cooperation between these non-dental rural health care practitioners and oral health care providers may improve oral health service provision for rural and remote residents such that oral health care interventions are more effective and result in appropriate referral. The National Oral Health Plan 2015-2014 in Australia aimed to encourage health professions to form better collaborative relationships (Oral Health Monitoring Group, 2015) to increase the understanding of the connections between oral health and overall medical health (National Advisory Council on Dental Health, 2012). The NOHP 2015-2024 proposes that oral health competency units be included as core components of medical, health and community services qualifications. It recommends that university programs should have oral health-focused units in their programs for non-dental health professionals, to establish the importance of the relationships between oral health and general health (Oral Health Monitoring Group, 2015). There are no formal policies addressing these issues and consequently this research project is well situated for original research to address these issues.

Teledentistry is a modern technology which uses the internet to transmit dental images and information from remote locations to a dental practitioner in a different location (Khan & Omar, 2013). Teledentistry utilises technologies to improve the remote facilitation of dental treatment and diagnosis in the physical absence of a dentist (Khan & Omar, 2013). It involves the electronic transmission of intraoral dental images, taken by either dental or non-dental practitioners, to a remotely located dental practitioner or specialist via the internet. Intraoral cameras are small networkable cameras that are used inside a patient's mouth to take magnified images and videos of

the teeth. The development of new technologies in image taking and transmission along telecommunication pathways has allowed dentists to expand on their diagnostic and education options.

Telehealth in medical care (the use of computers and telecommunications to enhance medical care), has been well documented in the literature (Haddad et al., 2014) but the applications of teledentistry are still reportedly misunderstood and underutilised (Mariño et al., 2015). Telehealth is recognised as a way to provide medical care to distant communities. Various forms of telemedicine are already used in medicine today which combine digital technologies, the internet and telecommunications to provide remote health care access to rural areas (Zimlichman, 2005). This technology has been shown to have applications for the remote diagnosis of medical conditions including psychiatric, cardiac and dermatological disorders (Klaz et al., 2005). Teledentistry has developed as a follow-on from this technology (Elliott-Smith & Hovliaras-Delozier, 2007).

The combination of access to electronic health records with telecommunication technology could potentially enable health professionals in rural and remote communities to communicate with one another and the patient. The integration of oral health records and medical records into this system, via e-health, which is the term used for communication and information technologies in healthcare, would be a significant improvement to patient care (Schleyer et al., 2012).

The potential for teledentistry to encourage better communications between medical and dental professionals needs to be examined more closely as a way to improve oral health care provision for patients living in rural and remote Australia (Elliott-Smith & Hovliaras-Delozier, 2007; Jampani et al., 2011; Mariño et al., 2015).

1.1.1 Researcher's reflexivity and contribution to original research

Researcher reflexivity provides another rationale for why this research project was embarked upon. It influences the approach to the research, the methods used, and the way that the findings are disseminated (Malterud, 2001).

This candidate has been a clinical dental practitioner for twenty-eight years. The first four years were spent working in the public sector in a Hospital Dental Clinic and with the School Dental Service in Queensland. The next twenty four years were spent working in private practice in a rural Queensland. This candidate dealt with many dental emergency situations, and experienced serious work overloads due to the shortages of personnel in the dental workforce in rural areas. Dental colleagues and I experienced little or no interprofessional communications or collaboration with the medical practitioners or allied health care providers in the region. Dental conditions and medical conditions were deeply segregated, and siloed professional behaviours were common. I had used

teledentistry for dentist-to-dentist communication for several years in my practice but the potential to include it in medical practice to allow the remote diagnosis of dental conditions in rural and remote patients presenting to a medical practitioner was a possibility that deserved further exploration.

This candidate consequently volunteered as a research assistant as part of a team from the Centre of Research Excellence in Primary Oral Health Care funded by the Australian Primary Health Care Research Institute (APHCRI). This larger parent project explored relationships between the primary care networks and dental practitioners in several states around Australia. The larger research project used convenience sampling and chose QLD and other Australian states as the project settings. As this candidate resides in a smaller regional town of Mackay in North Queensland, Queensland was chosen for pragmatic reasons such as for the travel requirements for face-to-face interviews. The inside knowledge and experience of this candidate provided insights about issues of concern and aan understanding of the desire to improve the situation, and hence embark on further investigation.

This candidate actively contributed to the collection and analysis of all of the contributing data from Queensland. After being trained by the primary supervisor during the first Queensland interview, this candidate took a substantial lead in the interview process for all of the participants from rural and remote Queensland, initially under supervision and then independently.

This PhD thesis further expanded the scope of the original study with an amended ethics approval to explore dental practitioner views , which were not included in the larger parent research project. This thesis also examines the interest of both dental and non-dental practitioners in the possible applications for introducing intra oral cameras into rural and remote medical practice to take images of dental problems which could then be assessed by dental practitioners in a more regional centre (teledentistry).

1.2 Research aim and research questions

The aims of this study were to: (1) describe the oral health care provision in rural and remote Queensland and (2) to report strategies perceived by the serving primary and dental care practitioners to improve the provision of oral health services to their communities.

To achieve the aims of the study, the following research questions (RQs) were formulated:

RQ1: What are the barriers and challenges to effective oral health care provision and access in rural and remote communities in Queensland?

RQ2: What is the relationship that exists between dental practitioners and the non-dental primary health care network?

RQ3: What strategies have been suggested to improve oral health in the rural and remote regions examined*?*

RQ4: What is the level of interest in the use of technology by non-dental practitioners and dental practitioners in management of dental problems?

The first two research questions addressed the first aim to describe the oral health care provision in rural and remote Queensland, and the second two research questions aim to report strategies perceived by the serving primary and dental care practitioners to improve the provision of oral health services to their communities.

1.3 Study setting: Queensland

Queensland is one of the largest states in Australia with an area of 1.853 million km². Over 50% of Queensland is classified by the Australian Statistical Geography Standard (ASGS) as "Very Remote" (figure 1.1) and the population is concentrated in the south east of the state (70.2%), with the remaining 29.8% living in regional Queensland (including rural and remote areas).

Queensland has a population of 5 million people which is predicted to increase by one-third to 6.1 million people between 2011 and 2026. Queensland's population is one of Australia's most geographically dispersed populations with health care services needing to be infiltrate into very remote and hard to access communities (Queensland Department of Health, 2013b). This predicted increase in population will have implications for the establishment of successful oral health service models, and this is one of the reasons why this study is timely, as it examines the strengths and limitations of three different operational oral health care delivery models. Around 33% of the population of Queensland are migrants or the children of migrants, with the majority of the original 19th century settlers coming from Britain and other parts of Europe. During recent times, there has been an increase in the number of migrants from South-East Asia (Queensland Government Statisticians Office, 2015). The 2016 Census showed that 4% of the residents of Queensland were of Torres Strait Islander or Aboriginal origin (Queensland Government Statitician's Office, 2016).

Queensland consists of vast areas of cattle and sheep grazing territory and has large gas and coal seam mining regions. Distances of many thousands of kilometres may separate communities from regional centres making the provision of quality dental care a challenging task.

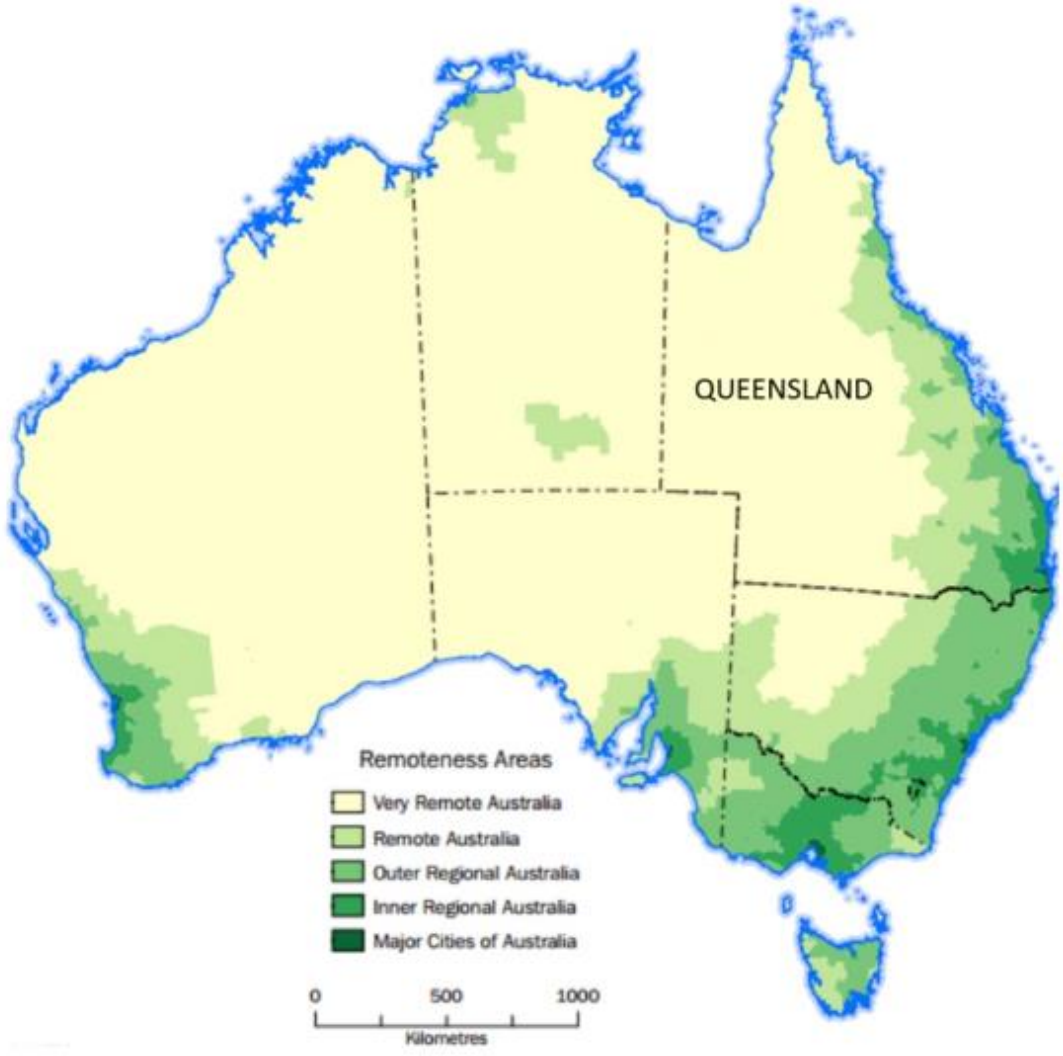

Figure 1.1: Australian Statistical Geography Standard remoteness structure 2011

Source: (Australian Bureau of Statistics, 2013a)

1.4 Oral health service arrangements in Australia and Queensland

Australia's universal health care system "Medicare" was introduced in 1984. All Australians contribute to the cost of health care according to their incomes via income tax and a Medicare levy (Department of Health, 2017). In order to provide free hospital care, as well as free or subsidised health care services and medications to all Australians, the Commonwealth and the State governments work co-operatively. Dentistry is generally not covered under Medicare although some rare exceptions do exist, such as for cleft palate surgery and certain government funded schemes (Department of Health, 2017). There have been many government oral health care funding provision

schemes historically in Australia and most of these have been superseded or shelved. A summary of historical government dental funding schemes is listed in Appendix A.

Oral health services in Australia are generally funded in two ways, either by providing free dental care in government dental clinics or by fee-for-service in private dental clinics. Private dental patients may or may not have private dental health insurance (National Advisory Council on Dental Health, 2012). Policy makers often consider oral health care as a separate condition from other medical conditions (Vieira & Caramelli, 2009). Free government oral health services are only provided for children up to 18 years of age and for adults with health care concession cards (Oral Health Monitoring Group, 2015). To be eligible for treatment at a government dental clinic as an adult in Queensland, patients must be above the age of completion for grade ten and must be eligible for certain concession cards. Most (85%) of Australia's dental services are provided by private dental practitioners who require fees for their services (Tennant & Kruger, 2013). It has been argued that without substantial structural reform to this government/private divide for the supply of dental services in Australia, there will continue to be challenges in implementing policies capable of improving oral health (Lam et al., 2015) . There are several charitable organisations that attempt to partially fill the void left by this private/public divide and offer free dental care services to the "working poor", i.e. those who do not qualify for a Health Care Card, but who also cannot afford to attend a private dental practitioner (See Appendix A attached). One such service providing philanthropic dental services to many rural and remote Australian communities (Royal Flying Doctors Service, 2017) is the non-government organisation (NGO) Mobile Dental Service. This mobile dental service is a philanthropic venture jointly funded by a private mining company, the Commonwealth Government and a NGO (Royal Flying Doctors Service, 2016). The number of communities receiving free oral health care from this service throughout Central Queensland is increasing, with 22 rural and remote Queensland communities receiving care in 2017 (Royal Flying Doctors Service, 2017).

1.4.1 Dental workforce in Australia and Queensland

The oral health workforce in Australia is made up of dental practitioners (dentists) and other oral health practitioners (dental hygienists, dental therapists, oral health therapists, dental technicians and dental assistants) (Sheiham, 1992). Under current legislation these oral health care practitioners all have specific roles and duties (National Advisory Council on Dental Health, 2012). Scope of practice is a contentious issue as reported in the literature with proponents supporting the use of oral health therapists in providing equitable access to oral health care. They analogise the midlevel oral health care providers to nurse practitioners in medicine who are able to provide a high level of medical service without direct supervision from a medical practitioner (Edelstein, 2011). In June

2017, the Dental Board of Australia released a Scope of Registration Practice Standard. This standard identified that other oral health care providers such as dental hygienists, dental therapists and oral health therapists could only perform procedures for which they are formally educated and only under the supervision of a dentist (Australian Health Practitioners Regulation Agency, 2017).

Table 1.1 below shows the different types of registered dental practitioners and the maldistribution of these oral health care providers in Australia per 100,000 population in 2014.

Table 1.1: Registered dental practitioners per 100,000 population, by practitioner type and remoteness area

Practitioner type	Major cities	Inner regional	Outer regional	Remote/ Very remote	Australia
Dentists	72.3	45.6	39.0	22.7	64.7
Oral health therapists	3.3	3.3	3.0	1.3	3.2
Dental hygienists	8.4	3.7	4.0	2.1	7.0
Dental therapists	5.2	6.2	7.7	5.9	5.6
Dental prosthetists	5.4	5.6	3.2	0.4	5.1

Source: (Australian Institute of Health and Welfare, 2014b)

1.4.2 Dental workforce

Australia has a maldistribution of dental practitioners with the vast majority practicing in major capital cities, with three times as many dentists practicing in cities and regional centres compared to rural and remote areas (Shiika et al., 2015; Tennant et al., 2013). The Dental Workforce Report from 2012 reports that there are 22.7 employed dentists per 100,000 population in remote or very remote Australia, compared to 72.3 employed dentists per 100,000 population in major cities. It documents the increases in dental workforce numbers where in 2009 there were 54.1 dentists, 5.6 dental therapists, 4.2 dental hygienists, 2.7 oral health therapists and 4.6 prosthetists, per 100,000 population (Australian Institute of Health and Welfare, 2014b).

The total numbers of registered dental workforce numbers in 2012 in Australia were 14 687 dentists, 1 425 dental hygienists, 1 117 dental therapists, 1 100 dental prosthetists, 15 381 dental assistants, and 675 oral heath therapists. An increase of 35.5% in dentists has occurred over a nine year period

and the Australian population has only increased by 15.1%. This led to the claim that an oversupply of dentists will soon be an issue in Australia (Australian Institute of Health and Welfare, 2014b).

This oversupply has been as result of the near doubling of the number of new dental teaching institutions in Australia since 1990, with the new schools predominately situated outside of capital cities. It has been contended that more student training in rural areas often leads to new graduates being more likely to practice in rural and remote regions (Kruger & Tennant, 2015). It has been predicted that if the rate of supply continues at this level there will be an oversupply of dental practitioners by 2020 (Dental Statistics and Research Unit, 2013). The question as to whether or not these practitioners will choose to take up practice in rural and remote Australia remains to be discovered, with one study suggesting that the issue of dental workforce maldistribution may be better addressed by the alternative strategy of employing other mid-level dental providers with appropriate scope of practice requirements to service these areas (Estai, Kruger, & Tennant, 2016c). Although the total dental workforce numbers are increasing across Australia, the number choosing to work in rural and remote locations is not rising (Godwin et al., 2014), lifestyle choices, isolation from professional peers and practice viability play a major role in work location choices for dental practitioners (Godwin et al., 2017; Godwin et al., 2016).

The Dental Board of Australia (2012) identified that the vast majority of dentists worked in either solo or group private practices across the relative workforce sectors. The majority of dental auxiliaries work in private practice: 92.7% of dental hygienists, 62.0% of oral health therapists and 90.5% of dental prosthetists (Dental Board of Australia, 2012). The distribution of dental practitioners across Australia in different roles is illustrated in Figure 1.2.

The locations of dental practices and government clinics across Queensland are shown in Figure 1.3. It is evident that there are lower numbers of dental practitioners per head of population in rural to remote areas compared to metropolitan regions. In Australia, Queensland has the highest concentration of the dental workforce along the Eastern coastline associated with capital city locations. Rural and remote areas are lacking in total dental workforce numbers demonstrating a considerable maldistribution (Olive et al., 2012; Perera et al., 2010).

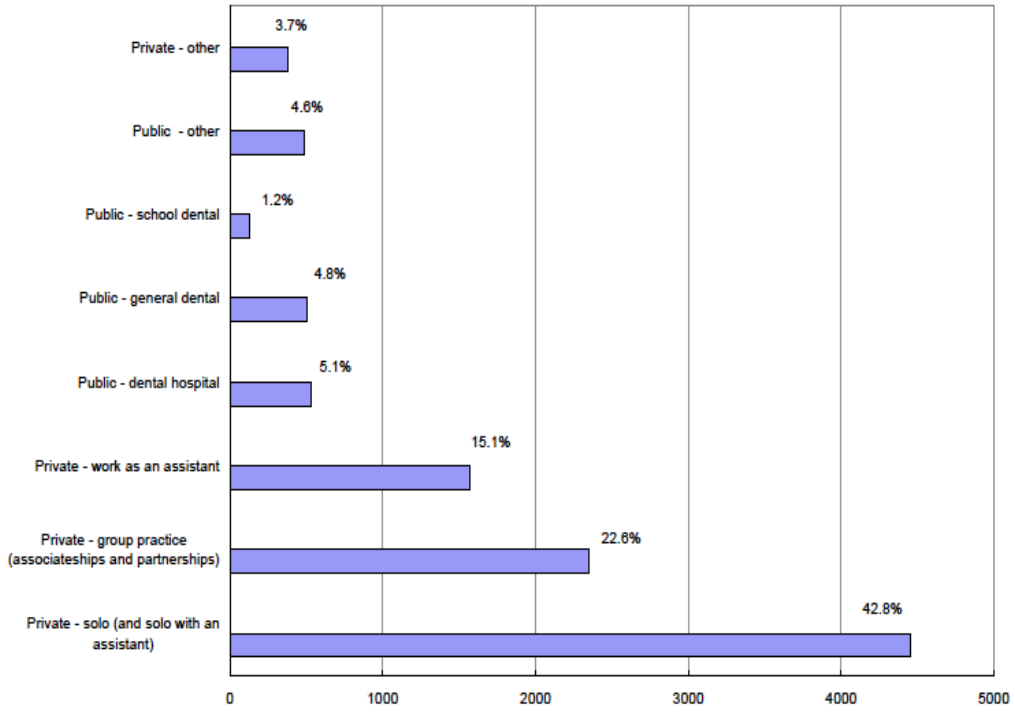

Figure 1.2: Distribution of dental practitioners across Australia by roles

Source: (Balasubramanian & Teusner, 2011)

Figure 1.3: Distribution of dental workforce across Queensland

Source: (Olive et al., 2012) using data from Dental workforce 2012

1.5 The Rural Primary Care Network in Australia and Queensland

The non-dental rural primary care network in Australia is made up of health care practitioners who are the first point of contact for the rural or remote patient with health problems (Kruger & Tennant, 2015; Lee et al., 2012; Maunder & Landes, 2005). Registered professionals making up this network vary depending on the specific needs of each community.

1.5.1 Rural Primary Care Providers

Combinations of the following health care professionals typically make up the primary care network in different communities: General Medical Practitioners, nurse practitioners, nurses, medical nurses, primary care nurses, child care and community nurses, midwives, hospital and private pharmacists, visiting or locum medical and allied health practitioners such as speech pathologists, physiotherapists, occupational therapists, dieticians, mental health workers, social workers, spiritual care providers, community developers and exercise specialists. (Australian Government Department of Health, 2013b). Some primary network health care providers have a permanent community base, such as a local clinic or hospital, but others might be visiting and therefore may be based at different locations. The primary care network can be made up of both private and government funded clinicians (Australian Government Department of Health, 2013b).

The primary health network aims to provide a full range of health-related services, which include prevention, screening and early intervention for all patients. It provides primary health care, hospital and emergency care, mental health, maternity health, aged care services, and preventative health care. Care is provided to specific population groups including older people, people with chronic disease, babies and children, Indigenous and Torres Strait Islander people and refugees (Keboa et al., 2016; Rural Health Standing Committee, 2009).

Effective primary health care is reported to involve a multidisciplinary approach to patient care co-ordination (Stans et al., 2013). The need for rural health practitioners to be multi-skilled is widely recognised and recent innovations include expanded roles for practice nurses, nurse practitioners and allied health therapy assistants (Cooper et al., 2007). The Queensland Health Department, in association with the Queensland branch of Royal Flying Doctors Association have developed primary health care guidelines to support the multiskilling needs of clinicians in remotely placed locations in Queensland. These resources include the “Primary Clinical Care Manual” with a specific chapter on dental emergencies included in the manual (The State of Queensland (Queensland Health) and the Royal Flying Doctors Service (Queensland Section), 2011).

1.5.2 Primary Care Networks in Queensland

The vast physical area of rural and remote Queensland, its low population density, limited infrastructure and the significantly higher costs of rural and remote health care delivery, make the delivery of quality medical care a challenge for the rural primary care network. Many of the major health facilities are in the South West of the state and the distances between health facilities in rural and remote Queensland can be large.

Queensland is divided into three health zones: Northern, Central and Southern and each zone is subdivided into Health Districts. Figure 1.4 shows the designated rural and remote primary health care facilities in Queensland, by health district. The residents from each district with a medical issue are serviced by one or more of these health care facilities and may also have access to a nursing home, outpatient clinics, community health centres or a Multi-Purpose Service. Indigenous Community Controlled Health Organisations utilise government salaried General Medical Practitioners who often work with specially trained remote area nurses and Indigenous or Torres Strait Islander health workers, to deliver rural and remote medical care to their population groups (Queensland Department of Health, 2011). Public oral health services unlike other health services, are not covered by the universal access principle and are mainly provided to the disadvantaged and the young, however the majority of dental services are privately funded (National Advisory Council on Dental Health, 2012).

1.6 Overview of the methodology

This qualitative study employed a descriptive multiple case study design utilising semi-structured interviews conducted between 2013 and 2016 (Creswell, 2014; Jacobsen, 2012; Klein, 1999). Interviews were conducted with 55 non-dental primary care providers and 12 dental personnel in eight rural communities in Queensland. These interviews were face-to-face individual or group field interviews and telephone interviews. These communities were identified by the Chief Dental Officer of QLD and met the following study inclusion criteria:

- They were classified as RA 2, 3, 4 or 5 by the Australian Standard Geographical Classification Remoteness Areas (ASGC RAs), i.e. non-metropolitan areas.
- Oral health care was a significant problem.
- There was no resident dentist/dental surgery, but at least one general medical (GP) practice, a health care facility and a pharmacy in the community.

Figure 1.4: The location of rural and remote classified Primary Health Care Facilities by type in Queensland

Source: (Statistical Output Health Statistics Centre, 2011)

Data was collected using semi-structured interviews. Participants were recruited over the telephone and follow-up field trips using both purposive and snowball sampling strategies (Rice & Ezzy, 1999b). Primary care providers were recruited through contact with the managers of the GP (medical) practice, pharmacy, hospital and other health care services of these communities. Dental practitioners were identified by the non-dental participants as those who had previously provided dental services to patients from the communities sampled, and were subsequently recruited through a snowball sampling technique. The interview guide was developed from the results of a literature review (Barnett et al., 2014) and was then piloted with a rural dentist and a pharmacist.

Recruitment continued until data saturation (Morse, 1995) was observed in the concurrent data analyses. Interview data were thematically analysed using the six phases of thematic analysis (Braun & Clarke, 2006a) with the assistance of a computer program Nvivo 10 (QSR International Pty Ltd, 2014). As the data was analysed it became evident that the eight communities examined received three different models of oral health care delivery and, as a consequence, three case studies emerged from the data. The first two case studies examined two different models of oral health care delivery by government dental services and the third case study examined oral health care delivery by a philanthropic mobile dental service. The three case studies were:

Case Study 1: A Central Call Centre where messages were left with an operator or with an answering machine. The call centre controlled all referrals from non-dental primary care providers in the communities to the public dental clinic in a large hub community.

Case Study 2: A directly contactable public dental practitioner attached to a hospital in a centralised hub community, where all referrals were dealt with directly by a dental receptionist or the dental practitioner personally.

Case Study 3: A philanthropic mobile dental clinic jointly funded by an NGO and a private Queensland mining company that travelled to some communities in rural and remote Queensland.

1.7 Strengths and Limitations

The strengths of this study lie in its methodological processes, research design, sampling and data collection process and in its foundational conceptual framework. The use of multiple case studies with thematic analysis allowed for data triangulation and cross referenced analysis with the checking of analysis by the candidate and the study supervisors. The involvement of the Queensland Director of Oral Health Services in the selection of the criteria meeting study communities to be included in this study ensured ethical compliance within Queensland. The recruitment protocols with invitation letters, study information outlines, consent forms and interview guides ensured completely

informed participation (See appendices E, F and G). The interview guidelines directed the interviews. Running notes in the fields followed by verbatim transcription of interviews, ensured data authenticity. The contributions to original research give this research project additional strength, with new findings surrounding the state of oral health in rural and remote Queensland and the significance of interprofessional relationships on patient outcomes.

The limitations for this study were the relatively small number of dental personnel (12) to participate compared to non-dental primary care provider participants (55). This was due to dental workforce shortages in the communities at the times of interview. The rapid staff turnover rates of General Medical Practitioners, pharmacists and other primary care providers in these regions, may have meant that the situations in relation to oral health in these eight communities may be different in other Queensland areas. Other limitations of this study were that the oral health journey experiences of specific patient groups such as Indigenous people, low income earners and other groups were not examined. Indigenous Health Care Workers were not actively recruited in the initial planning processes for this study but three such people were incidentally interviewed in the second case study, which greatly enriched the data. The patient experience surrounding oral health care access in rural and remote communities would have contributed considerably to the overall picture and is an area of future research.

1.8 Structure of the thesis

This thesis is divided into seven chapters with supporting information being contained in the appendices attached at the end of this thesis. The following section provides an overview of all the chapters.

1.8.1 Chapter 1 – Introduction

This chapter presents the aim and objectives of the study and provides background information of the study as well as its structure.

1.8.2 Chapter 2 – Literature Review

This chapter offers a detailed description of the search strategies utilised when searching for relevant literature to develop an understanding of the background for this research project. It critically reviews literature on oral health in rural and remote Australian and international communities, and on the funding systems in Australia and developed countries to give a feel for where Australia is situated in terms of health care provision and oral health care provision. Any literature relating to relationships between medical and dental health providers in Australia and worldwide, are reviewed. This chapter also reviews and evaluates the current literature on the

utilisation of alternative or innovative methods of delivering oral health care to rural and remote communities. The conceptual framework which guides the research project is developed and presented at this point.

1.8.3 Chapter 3 – Research Methodology

This chapter presents the research design of the study. It reports the planning and structuring procedures that enable the arrangement of this project. It determines the problems being researched and defines the research aims and questions. It describes the research methods and the research approach. The processes for recruitment of communities are described. The data collection processes with face to face group and individual field interviews are described and the interview guide is presented and described.

This chapter then describes the thematic analysis process and how this helped the candidate to make sense of the data and to eventually organise the findings into three descriptive case studies. The characteristics of the communities and service delivery models, for each of the three case studies will be outlined. Reliability and validity strategies are presented and the processes by which ethical approvals were achieved are described.

1.8.4 Chapter 4 – Results

The results are presented as three case studies. The eight rural and remote Queensland communities are grouped into three case studies that each receive oral health services via a different model of oral health care delivery. Qualitative data is presented thematically to give a descriptive representation of the analysis. Each case study has thematic representations grouped under headings which vary between case studies. Some of the results are similar across the three case studies and similar thematic headings reflect this. However, each case study also describes different challenges to effective oral health care provision, different communication and referral pathways, and different strategies to improve access to the oral health care service.

All of the communities sometimes accessed oral health care services through sporadic visits from fly-in/fly-out private dental practitioners, irregular school dental services and Indigenous oral health services, or by travelling to regional private dental practitioners. The nature of these services to the communities grouped within the three case studies is also reported.

1.8.5 Chapter 5 – Discussion

The participant responses to the four research questions guide this discussion chapter. These responses are related back to the literature review to determine what similarities or differences are evident. This chapter discusses the barriers and challenges to effective oral health care access faced

by residents in the eight rural and remote communities examined in this study. The three different oral health delivery models had specific challenges, which are discussed. The strategies to address these challenges across the eight communities and then specifically to each model of oral health service delivery are examined. References to the literature provide points of discussion. The nature of interprofessional relationships and the effects of these relationships on patient outcomes is explored.

Finally the interest that both dental and non-dental primary care providers have in the use of dental technology to manage oral health issues is discussed, compared to evidence in the literature of other teledentistry projects. The conceptual framework is reviewed in this chapter to accommodate the results that emerge from the collective data analysis.

1.8.6 Chapter 6 – Conclusion

The final chapter summarises the findings, demonstrates the significance of the research and re-establishes the interconnection between the literature and the results. This chapter offers recommendations that might address some of the barriers and challenges faced by rural and remote communities in accessing effective and timely oral health care. Strategies to address some of these challenges are presented and it is recognised that not all communities face the same set of circumstances and so there is not one solution that will address the issue of oral health care access for these eight rural and remote Queensland communities. An "ideal" hypothetical oral health care delivery model is proposed that addresses many of the oral health access issues that have emerged from the findings from this research. The strengths and limitations of the study are reviewed and the possible areas that require future research are detailed. Finally, the ways that the findings have been disseminated to a wider audience are outlined.

1.9 Conclusion

This chapter presents an overview of the thesis. Firstly, the purpose of and reasons for the study are explored, followed by the background information of the research and the rationale of the study. Then the research aims and objectives have been presented, followed by an overview of the methodology, research approaches and the data analysis procedures. The strengths and limitations for this study were then described. Finally, this chapter presents the structure of the thesis with an overview of each chapter. The next chapter will review the literature relevant to the study.

Chapter Two: A Review of the Literature

"Reading furnishes the mind only with materials of knowledge; it is thinking that makes the material ours" John Loche (English philosopher and physician born 1632 and died 1704).

2.1 Introduction

This chapter explains the methods used to review the literature and outlines the search strategies used and presents the results of the review. The review of the existing literature provides a backdrop for the research project. The oral health situations of residents in rural and remote Australian and overseas communities are explored in the literature review. The trends in differing oral health status between rural and metropolitan communities, the impacts that poor oral health has on these populations, and the oral health presentations to non-dental primary care providers, will be examined. Oral health funding arrangements and oral health care delivery mechanisms will also be explored.

The potential for the utilisation of dental communication technology, "teledentistry" to improve oral health care services to rural and remote residents in Australia will be discussed. Teledentistry projects in Australia and around the world will be examined and explained in relation to design, internet and security issues, the population groups it might advantage, and both dentist and patient perceptions of the practicality of the technology for improving rural and remote oral health care provision.

A conceptual framework will be presented which will be developed from the literature review and will form a scaffold that will direct this research project.

2.2 Literature review methods

A variety of academic, scholarly, current and authoritative sources were utilised in the literature review. Databases were accessed via University of Tasmania library resources including PubMed, CINAHL and Scopus, with books, journal articles, reports, government documents, conference proceedings and web resources such as magazine and newspaper articles, being utilised. This section describes the search strategy and selection processes that the candidate used.

2.2.1 Search strategy

This review was undertaken between January 1990 and December 2017 and limiters placed on the searches were abstract availability, and English-only language studies. Both quantitative and qualitative papers on this topic were included in the review. There was considerable turnover of data in relation to dental workforce statistics and teledentistry issues, and consequently updates were conducted on these issues regularly to ensure the review was current. The reference lists of included journal papers were searched for other relevant citations and a snowball technique revealed further suitable literature. Grey literature such as government reports, web pages, and magazine and newspaper articles were searched using Google Scholar and Google Chrome.

The search of databases was undertaken using a combination of key phrases and words. These included: dental or oral health care, dental problems, rural, remote [health], medical practitioners, doctors, pharmacists, nurses, allied health, practice nurses, community child care nurses, speech pathologists, occupational therapists, primary care networks, primary care providers, emergency department, rural dental care, professional relationships, interdisciplinary education, corroboration, government dental funding Australia/ worldwide, intraoral cameras, teledentistry, dental technology and national broadband network.

These were entered in the Boolean combinations:

- *(Rural OR remote OR regional) AND ("health care workers" OR doctors OR medical practitioners OR "Emergency Departments") AND ("oral health care" OR "dental emergencies")*
- *("intraoral camera" OR teledentistry) AND (communication OR networking) AND dentists AND (medical practitioners OR pharmacists OR "primary care network")*
- *(dentist OR "oral health care practitioner) AND (doctor OR medical practitioner OR pharmacist) AND ("interprofessional education" OR collaboration)*
- *(Rural OR remote OR regional) AND ("Indigenous health care workers" OR "Aboriginal oral health") AND (dental practitioners OR dentists) AND ("oral health care" OR "dental emergencies")*

2.2.2 Search results

A broad sweep of the existing literature from Jan 1990 to December 2017 revealed 1,200 data sources including: journal articles, government reports, web pages, and other grey literature such as radio interviews and newspaper articles. Of the resources 244 were duplicates or obviously irrelevant and were established to be not directly relevant to the research topic. Consequently, 956 references were reviewed for topic specific content and a further 544 journal articles, government

reports and other grey literature documents were excluded due to irrelevance. The remaining 412 relevant references of which 323 were journal articles, and 89 sources of government reports, web pages, radio interviews or newspaper articles were drawn upon in this literature review.

Figure 2.1 gives a representation of the breakdown of the search that produced the final 341 literature resources, which were then further categorised into relevance by topic heading.

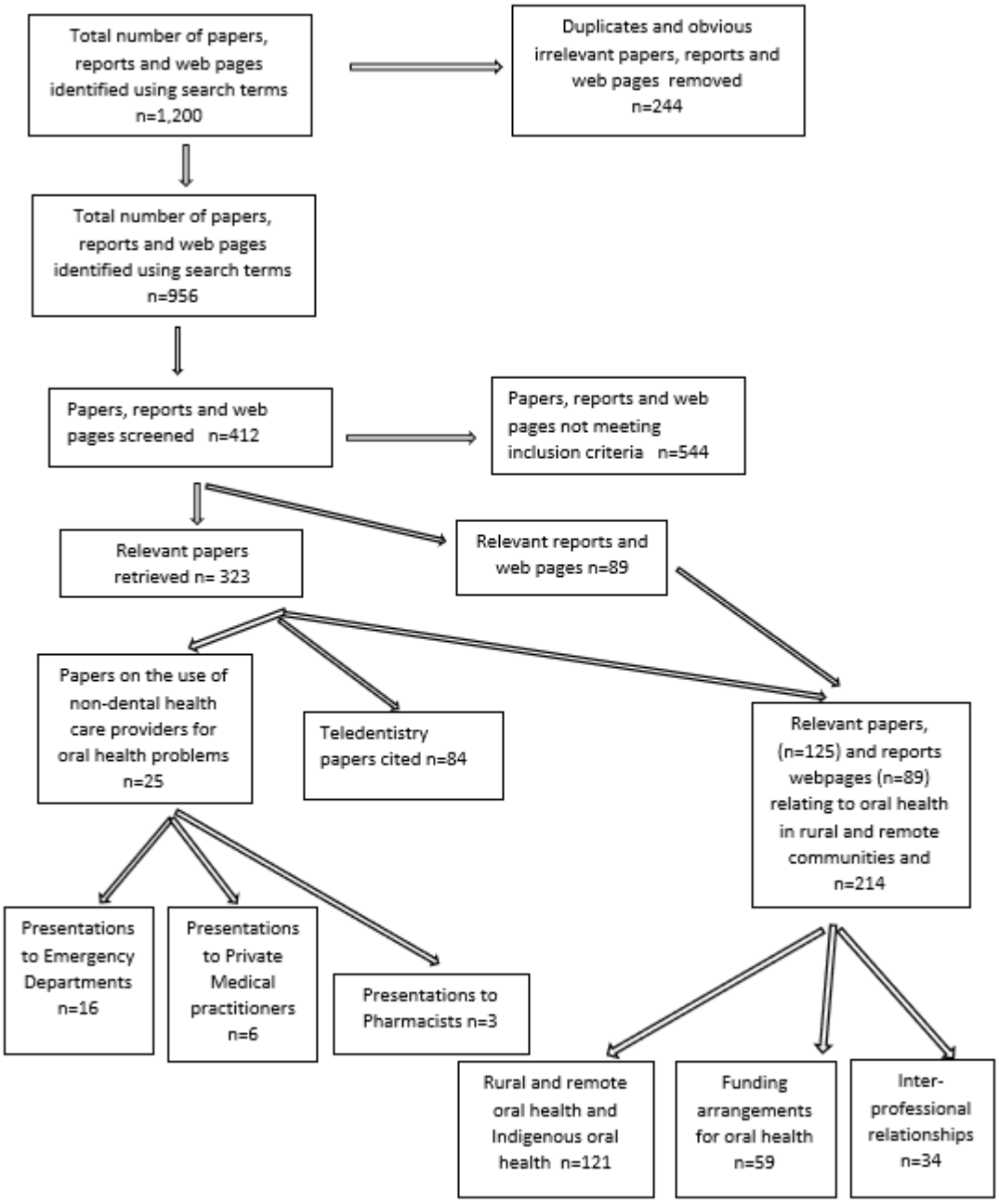

Figure 2.1: Review process of published papers from January 1990- December 2017

The review found 25 studies on the use of non-dental health care providers for oral health problems. These included emergency department medical staff, private General Medical Practitioners, pharmacists, allied health care providers and Indigenous Health Care Workers. People presented to Emergency Departments for dental issues (sixteen), private medical practitioners (six), and pharmacists (three) for dental treatment and advice. Non-dental health care providers were accessed for oral health advice and/or treatment by adults in six studies, and 12 studies showed both children and adults presenting to non-dental care providers. Government reports and web pages accounted for the other 89 references that helped to build the picture of oral health status in Australia and around the world.

There were 214 papers, reports and web pages concerning other relevant issues relating to oral health in rural and remote communities included in this review. Funding arrangements in Australia and overseas accounted for 59 journal article references, and references to websites and government reports. Rural and remote oral health and Indigenous oral health issues such psychosocial challenges, medical links to dental issues, and oral health care access issues were referenced from 121 journal articles and government web pages. Interprofessional relationships between dental and non-dental health care providers were explored in relation to educational interactions and referral pathways from 34 articles.

Relevant journal articles in relation to the telehealth and teledentistry issues examined in this study were limited in number up to March 2014 with only 17 papers being included at that initial stage of the literature review. This demonstrated a gap in the literature and justified the importance of re-examining this modern innovation as a possible way to improve interprofessional communications, throughout this research journey. Since 2014 another 110 relevant journal articles were found. This explosion of data has shown the rapid growth in the interest for these technologies to enhance the practice of remote dentistry and the candidate stopped searching for new literature in December 2017. A total of 127 teledentistry related journal articles were sourced of which 43 were removed as not relevant and 84 have been directly cited. The sections below synthesise the findings of the literature reviewed.

An annotated bibliography was kept with summaries of all of the articles listing category, author, aim, sample size, methods of data collection, methodology, summary of content/findings, recommendations and conclusions. This large excel sheet document was presented to the candidates' primary supervisor at a supervisory meeting to cross-check for suitability.

2.3 Oral health in rural and remote Australia

Rural and remote residents throughout Australia are classified as priority populations who have been identified as experiencing poorer oral health than other parts of the population, with adults and children living in these regional or remote areas having higher levels of tooth loss and more untreated tooth decay (Watt & Sheiham, 2012). Three in ten adults in Australian have untreated dental decay with untreated decay rates increasing with geographical remoteness (Chrisopoulos et al., 2016). In a National Survey in 2013, 19% of adults aged 65 and over had no natural teeth and of those with their own teeth, 42% required dentures to supplement the loss of one or more of their own natural teeth (Chrisopoulos et al., 2016). Adults from particular cultural groups living in remote communities were identified (Mouradian et al., 2004) to have noticeably poorer oral health (Chrisopoulos et al., 2016). Indigenous people are one of the majority groups who experience poorer oral health access and outcomes than other Australian population groups (Kruger, Jacobs, et al., 2010). People living in rural and regional areas are more likely to present to dentists with emergency dental situations than those in larger cities (Brennan & Ellershaw, 2012). These dental visiting patterns of rural and remote residents raises the risk of poorer dental health. In particular, 33% of rural people have untreated decay compared to a 25% of city residents (National Advisory Council on Dental Health, 2012) and more than 30% of rural residents have moderate to severe periodontal disease than just over 25% of city residents (National Advisory Council on Dental Health, 2012).

There is no single factor that completely explains why people of rural and regional Australia have poor visiting patterns and why they are at greater risk of poor oral health. However, level of income, social-economic status, insufficient public dental funding, lower levels of water fluoridation and different attitudes towards the importance of good oral health are key factors (Crocombe et al., 2016; Crocombe et al., 2012; Crocombe et al., 2013). Moreover, there is an association between access to dental services and risk of poor dental health. The National Advisory Council on Dental Health stated that “residents of rural and regional Australia are at greater risk of poor oral health outcomes with income playing a role, but with the added complexity of workforce maldistribution making access more difficult” (Australian Bureau of Statistics, 2013b). In Australia there are more than three times as many dentists practising per 100,000 population in major cities than in remote or very remote areas (Chrisopoulos & Beckwith, 2011). In addition, the rates of other types of practitioners including dental therapists and prosthetists were lowest in remote/very remote areas (Chrisopoulos & Beckwith, 2011).

2.3.1 Oral Health in Rural and Remote Queensland

The Queensland component of the 2004-2006 National Survey of Adult Oral Health showed that 27.6% of Queensland residents had untreated dental decay compared the nationwide evaluation of 25.5% (Slade et al., 2007). Queensland residents who were government Health Care Card-holders had the highest incidences of untreated dental decay (40.3%), whilst those holding private dental insurance had the lowest incidences of untreated dental decay (21.2%) (Australian Institute of Health and Welfare, 2008). From July 2008 to June 2010, dental conditions were the ninth most common presentation for ambulatory care sensitive hospital admissions in Queensland, New South Wales, Victoria, Western Australia, South Australia and the Northern Territory (Australian Health Ministers Advisory Council, 2011). When data for Queensland was separated out from this total data pool it was reported that dental conditions were the third most common reason for potentially preventable hospitalisations in Queensland from 2007-2008 (Houweling, 2008).

2.4 Indigenous Oral Health in Australia

The poorest oral health among Australian people is found in the Aboriginal and Torres Strait population (Jamieson & Sayers, 2008). Findings in the literature indicate that the highest amount of oral disease is evident in rural and remote Indigenous Australians, with this group having poorer oral health than their urban or non-Indigenous contemporaries (Kruger, Jacobs, et al., 2010). It has been reported that 57% of Indigenous Australians have one or more teeth affected by dental caries (Bishop & Laverty, 2015).

Indigenous children from all age groups have twice the number of missing or decayed teeth compared to non-Indigenous children. Thirty-two percent of Aboriginal or Torres Strait Islander children experienced dental caries by the age of 14, with 7% of 5-9 year old Indigenous children having their teeth removed due to dental decay (Australian Health Ministers Advisory Council, 2011). Potentially preventable hospitalisations for conditions of dental origin have increased significantly during a ten year period from 2005-2015 in Australia. These hospitisations were highest for Indigenous people (Kruger & Tennant, 2015). Those from the most disadvantaged areas had the highest rates of hospitalisation (Kruger & Tennant, 2016).

Dental decay often goes untreated among the Indigenous population because Indigenous people often do not actively seek oral health care. The reasons for this include the high cost of treatment (43%); long waiting lists (20%); and distrust of the dental professional (19%) (Jamieson & Sayers, 2008). This wariness has been partly attributed to the fact that the cultural sensitivities associated with Indigenous health is poorly addressed and access to culturally appropriate dental care is often not available in rural and remote communities (Jamieson & Sayers, 2008; Williams et al., 2011). One

of the major understandings associated with culturally appropriate oral health service provision is the requirement for facilitation of Indigenous community involvement in the development and running of the service (Williams et al., 2011). A study in 2014 found that to increase the effectiveness of oral health care for Aboriginal and Torres Strait Islander peoples, several aspects of this service provision needed to be addressed. The "social view of health" was a vital aspect in cultural sensitivity. Creating a welcoming service by employing Aboriginal staff as well as supplying transport, outreach centres, and walk-in centres with cultural protocols were suggested strategies to increase Indigenous patient attendances (Freeman et al., 2014).

2.4.1 Indigenous oral health in rural and remote Queensland

In 2016, Queensland hospitals admitted more than 400 Indigenous children under the age of nine with severe dental caries. A Queensland study in 2018 showed that most young Indigenous Queenslanders are brushing their teeth but only 30% were brushing them twice daily. Only 40% of Indigenous households were consciously limiting the amount of sugary foods and drinks their children consumed (Queensland Health, 2018).

To address these issues in Queensland several programs have been developed. *Crocodile Smiles* is an educational and support orientated program designed for Indigenous children in the Cape York and Cairns Health Service Districts, and is successful in achieving the aim of addressing the issues specifically related to Indigenous oral health with cultural sensitivity. The aim of this Queensland based Indigenous oral health program is to supply resources for Indigenous Health Care Workers to help teach children and families about the importance of oral health (Williams et al., 2011). Another initiative by the Queensland government has been the development of two pictorial flipcharts to increase the oral health literacy of Aboriginal and Torres strait Islanders in a culturally appropriate way. The flipcharts are aimed at Queensland school children and their parents, respectively, and teaches oral hygiene techniques and diet for healthy mouths (Queensland Health, 2016).

Filling the Gap is another successful community outreach program that was established in 2009 by the University of Adelaide's School of Dentistry. *Filling the Gap* has a clinic based in far North Queensland (Cairns) and is a partnership with a Community Controlled Indigenous Health Service in the area called Wuchopperen. Volunteer dentists are recruited by the *Filling the Gap* outreach program to work in this Indigenous community (Jackson et al., 2009). The program has expanded over the years and has now recruited 180 dentists to work in other Indigenous controlled health services. *Filling the Gap* provides funds for the airfares to, and accommodation, in Cairns. Dentists volunteer for between one and two weeks at a time. In addition, volunteer dental hygienists, therapists and dental nurses also provide their support (Australian Government Department of

Health, 2013b). This program also works in partnership with the Muru Marri Indigenous Health Unit and the Nura Gili Indigenous Programs at the University of New South Wales (Jackson et al., 2009). A study in 2016 examined some rural and remote Indigenous Queensland communities and identified issues in relation to the large distances that these communities often were from oral health service bases. This study concluded that the use of digital technology and the use of the internet might enable Indigenous Health Care Workers to provide preventative oral health care and education remotely (Caffery et al., 2016).

2.5 Oral Health Funding Arrangements in Australia

Studies have suggested that having separate funding systems for dental and medical care may be a further possible cause of segregation in perceived roles of heath care providers (Andersson et al., 2007; Bissett et al., 2013). In Australia, the exclusion of oral health care from the country's universal health care system Medicare, may be a significant factor in the segregation and lack of interprofessional communications between dental practitioners and other members of the primary medical care networks (Department of Health, 2017). In other parts of the world different funding arrangements are available for oral health care. Many people in the USA, for instance utilise a funding mechanism via a "Health Savings Account". This health savings account pays for medical and dental expenses with funds deposited into these accounts either personally or by the employer before it is taxed. These funds are only allowed to be used for dental and other medical expenses (Mertz & Finocchio, 2010). See Appendix B for oral health care funding arrangements in other parts of the world.

2.5.1 Oral health funding arrangements in Australia

Funding of oral health services in Australia is achieved by a complex combination of public, private and non-government organisations. Government assisted care from dental practitioners employed in the government sector, personal payments, by those who may or may not have private dental insurance to practitioners in the private sector, or by non-government, not-for-profit charitable organisations (National Advisory Council on Dental Health, 2012).

The total level of expenditure on oral health in Australia increased from $5.1 billion in 2004-05 to $9.9 billion in 2015-2016 (Australian Institute of Health and Welfare, 2017). The majority of the cost of this dental care ($4.7 billion) falls to the individual and in 2011-12, individuals were responsible for 57% of the total cost of dental care compared with only 12% of the cost of all other non-dental health services

2.5.1.1 *Privately Funded Dental Care*

Private practice makes up the majority (75.0%) of the oral health workforce in Australia (Australian Institute of Health and Welfare, 2014b). A snapshot of a 12 month period in 2012 showed that 89.5% of Australians who visited an oral health care practitioner in that period visited a private dental clinic, while the remainder attended a government clinic (Australian Bureau of Statistics, 2013b). Patients using the private sector either did or did not have private dental health insurance to help finance their dental care (Biggs, 2008). More people living in major cities (59%) had dental insurance than those in outer regional areas (46%) (Brennan & Ellershaw, 2012; Chrisopoulos et al., 2016). The national phone survey conducted in 2010 concluded that those individuals with dental insurance were more likely to visit a dentist because the insurance was perceived to be a buffer against the financial burden of dental care (Brennan & Ellershaw, 2012). In 2012, the literature reported that 27.4% of all Australians avoided visiting the dentist due to financial burden and low socioeconomic households had more difficulty funding dental appointments than higher income families (Australian Institute of Health and Welfare, 2014c; Chrisopoulos et al., 2016). In 2012-2013, 18.8% of Australians (i.e. nearly one in five) aged 15 years and over who had a dental problem, delayed or did not go to a dentist due to cost, which was more than triple the rate (5.8%) for those delaying to see a General Medical Practitioner (Oral Health Monitoring Group, 2015).

Teusner and colleagues reported on the financial repercussions of private dental care on Australians (Teusner et al., 2013). Data on dental expenditure from a sample of 3000 randomly selected adults aged 30 to 61 years were taken from the electoral roll. The findings indicated that the average amount of money Australians spend on dental work a year was $702 and the average out of pocket expense was $489. The main reason reported for a person going to the dentist was for toothache and these patients spent more money fixing that problem than those who went regularly for a check-up and preventative treatments. Those insured averaged $146 out of pocket expenses compared to $320 if uninsured (Teusner et al., 2013).

2.5.1.2 *Federal Government Funded Dental Care*

In the past, Australian governments have considered introducing a universal dental care access system, which has generated considerable debate in the literature. The huge financial cost this would impose on the government makes it unlikely to succeed. It has been estimated that the cost to implement a universal dental scheme could be up to $7.5 billion (Spencer, 2004). In 1986 (the Layton Inquiry), 1998 and then again in 2003, there were separate senate inquiries into the inclusion of dentistry into Medicare (Biggs, 2008). Professor John Deeble (who is credited with designing Medicare) stated that dentistry was not suitable for a universal scheme as “Insurance works best for things that are episodic and unpredictable. Dental illness is slow: it is not episodic, and it is not

unpredictable, because you know you have it for quite a long time" (Deeble, 2003). A universal coverage system for dental needs would be faced with many issues and would need to be examined to ensure equity of care across the population. It would need to remain specifically aimed towards people suffering from the burden of dental disease (Tennant & Kruger, 2014). The focus of care could be concentrated on those small known clusters of society with persistently higher levels of oral health disease (Sohal et al., 2017) .

In 1994, the Commonwealth Government introduced the Commonwealth Dental Health Program (Australian Institute of Health and Welfare, 1996). This was the original policy that began to direct States and Territories to be responsible for their own oral health by directing more funds specifically to them (Biggs, 2008). The Commonwealth Government plays a role in financing oral health services, but the individual State governments contribute to the training of dentists, dental prosthetists, some hygienists and dental assistants through funding to the TAFE sector (National Advisory Council on Dental Health, 2012).

The Council of Australian Governments (COAG) is the peak intergovernmental forum in Australia and has endorsed Australia's National Oral Health Plan for the period 2015-2024. The goal of this oral health plan is to improve oral health status across the Australian population and to consequently improve the overall health and wellbeing of Australians. It is postulated that if this plan is implemented it will substantially reduce the burden of poor oral health on the population (Oral Health Monitoring Group, 2015).

In 2016, the Commonwealth Government pledged $320 million over three years through the National Partnership Agreements to assist individual State Governments to provide public dental services to adults (Lalloo & Kroon, 2016). States and Territories were promised $345.9 million over the budget periods 2012/13 to 2014/15. In the 2014/15 Federal Budget, an additional $119.6 million was allocated under this National Partnership Agreement (Department of Health, 2015). These new funding arrangements for oral health are split between the Commonwealth Government and the States and Territories, with the Health Minister describing current dental arrangements, as "fragmented with funding models that increase risks of inefficiencies and service gaps" (Biggs, 2015).

People in possession of specific concession cards including: Health Care Card, Senior's Health Card, Veterans' Affairs Card, Pensioner Card or Prisoner Identification Card are eligible for government funded dental care. While the type of services available to adult patients in public dental clinics are generally similar across all the States and Territories, it is usually limited to emergency dental care and general dental treatment (Queensland Government, 2013). The public dental clinics are mainly located within hospital grounds or in Community Centres and approximately 400,000 people are on

the waiting lists for all government dental clinics in Australia with waiting times of up to five years (National Advisory Council on Dental Health, 2012). People living in remote or very remote areas of Australia are more likely (12%) to visit a public dental clinic, despite the waiting period, than those living in major cities of Australia (7.4%) (Australian Bureau of Statistics, 2013b). Children in Western Australia, Queensland and South Australia have a dedicated school dental service (Queensland Health Department, 2013). The Northern Territory has a combination of community-based services and school dental services for children. New South Wales, Victoria, Tasmania and the Australian Capital Territory treat their children mainly in community-based clinics (National Advisory Council on Dental Health, 2012). See Appendix A attached, for other Commonwealth Government funded oral health schemes.

2.5.1.3 *Queensland Government oral health funding schemes*

In each state, Hospital and School Dental Clinics in each State are funded by the State Government via the National Partnership Agreement (Department of Health, 2015). In Queensland, there are approximately 180 mobile dental clinics, 120 fixed school dental clinics, 14 self-drive mobile dental clinics, and 140 community dental clinics. Queensland's Department of Health has dental clinics attached to 16 of its Hospitals and Health Services. There are a few specialist services available but these are accessible only to an individual who is eligible for government financial assistance or are "means tested" and these services are prioritised based on the severity of the problem (Queensland Health Department, 2013). Oral health services are also provided to prisons and aged care facilities via outreach services (Queensland Health, 2013).

To be eligible for treatment at a Government dental clinic in Queensland, patients have to be above the age of completion for grade 10. They must be resident in Queensland and fulfil certain criteria which include holding one of the following concession cards: Health Care Card, a Commonwealth Senior's Health Card, a Queensland Seniors card, a Veterans Affairs Concession Card, Pensioner Concession Card, School Oral Health Service eligibility, Prison I.D or being a Ward of the State. These individuals can then receive free treatment via the public sector dental clinics. Dependants of people in possession of these cards are also eligible for treatment. The School Dental Service provides free dental treatment to all Queensland children from pre-school to grade 10 at school (Queensland Health Department, 2013). In the public health sector in Queensland, 1500 children are seen by dentists each day (Queensland Health, 2013). All remaining Queenslanders who do not meet the criteria above must seek dental care via the private dental practices (Australian Government Department of Health, 2013a; Queensland Department of Health, 2013a).

The Queensland Government Public Dental Voucher Scheme is a voucher system that was introduced in February 2012 in Queensland by the Newman Government that allowed eligible patients to take a voucher from the government clinic to a local private dental practitioner to have dental treatment. In 2014, the introduction of these vouchers effectively halved the waiting list in public dental hospitals in Queensland (Queensland Government, 2014). The amount of $8 million received from the Commonwealth Government via the National Partnership Agreement was used by the Queensland Government to expand its voucher program which allowed public patients to be treated by private dentists. Between 28 February 2013 and 30 April 2014, 97,000 dental vouchers were distributed across Queensland and about 91,000 were claimed. The Queensland State Government used their yearly public dental services allocation of $187 million to add to the Commonwealth contribution. More than $14 million worth of vouchers were distributed during this period at a value of up to $750 each. Some patients needed to supplement the amount issued on the voucher with their own money but others had money remaining on their voucher which was recycled back to the scheme (Wardill, 2013). Queensland's health minister at the time, Lawrence Springborg, stated "between July 2013 and April 2014 about 17% of all public dental service activity was provided privately, with the remaining 83% provided by public oral health staff" (Jabour, 2014).

2.6 Oral health presentations to non-dental health providers

When there is a lack of access to timely oral health services, individuals are likely to utilise other types of health services for their dental issues.

2.6.1 Global perspective

The evidence from the international literature indicates that people who have difficulty in accessing dental services may present to hospital emergency departments (EDs) (Cohen et al., 2011; Cohen et al., 2008; Lee et al., 2012) or medical practices for treatment (Britt et al., 2000; Cohen et al., 2011; Cohen et al., 2008; National Advisory Council on Dental Health, 2012). For example, an American study (Cohen et al., 2011) found that a majority of their respondents reported the inability to access a dentist as the most important reason for seeking care from an emergency hospital department (Cohen et al., 2011). In addition to the traditional health care services such as emergency hospital departments and private General Medical Practitioners, individuals with dental problems also may seek treatment and advice from pharmacists (Cohen, Akin, et al., 2009; Pau et al., 2000). In particular, Cohen and colleagues (2009) suggested that about 20% of the respondents consulted a pharmacist for their toothache. Their study indicated that pharmacists provided an important source of professional advice for patients with pain as they were consulted as frequently as medical

practitioners and more than twice as frequently as hospital emergency departments (Cohen, Akin, et al., 2009).

Although non-dental health care settings including hospital emergency departments, private medical practitioner practices and pharmacies are an important source of care for oral health problems, studies suggested that these sources are only used for temporary relief of pain and do not provide definitive treatment. For instance, research found that most people seeking dental treatment from emergency hospital departments and medical practitioners subsequently visited a dentist for definitive resolution (Cohen et al., 2011; Cohen et al., 2008). Cohen and colleagues suggested that medical practitioners generally lack substantive training in dentistry and very few doctors at the emergency hospital departments have been trained in the management of dental problems (Pennycook et al., 1993). These researchers concluded that management could be improved by the better training of medical students and doctors to include education on the management of emergency dental conditions (Pennycook et al., 1993). In addition, most emergency departments experience a shortage of readily available dental services and hence are less likely to provide a resolution of dental problems (Cohen et al., 2008). Similarly, a UK study revealed that pharmacists advised customers to see a dentist in approximately 95% of cases and 100% gave short-term pain relief (Maunder & Landes, 2005). This study examines how non-dental primary care providers manage oral health presentations in the eight rural and remote communities selected for study.

2.6.2 Australian Perspective

In an Australian context, people who cannot access dental care have also been reported to seek assistance through other services including General Medical Practitioners. It is estimated that there were over 750,000 encounters with Australian General Medical Practitioners in 2011 for dental diseases and complaints (National Advisory Council on Dental Health, 2012). Consistent with the literature, General Medical Practitioners in Australia do not provide definitive treatment for dental problems. General Medical Practitioners commonly provide prescriptions for pain relief, antibiotics, advice on oral hygiene and referrals to dentists (Barnett et al., 2014; Cohen et al., 2011; Maunder & Landes, 2005).

People who delay in accessing definitive dental treatment may consequently present for repeat appointments until eventually they are admitted to hospital to treat serious infections. During the period 2006-2010 the rates of potentially preventable hospitalisations related to dental conditions were higher for inner regional, outer regional, remote and very remote areas than for major cities. (Australian Institute of Health and Welfare, 2014b). These high rates of potentially preventable hospitalisations may have been avoided if timely and adequate non-hospital care had been provided

(Kruger & Tennant, 2015). This raises the concern that people in these areas may have been hospitalised due to the lack of adequate and timely preventive dental care in community settings. Theoretically, complications from dental disease are preventable by providing adequate preventive care and treatment (National Advisory Council on Dental Health, 2012).

2.7 Inter-connection between oral and medical health

Good oral health is an integral aspect of overall general medical health and it has been established that there is an association between systemic diseases and dental infections (Critchlow, 2017; Hayashi et al., 2017; Liljestrand et al., 2016). A medical link between pregnancy and gingivitis was established as far back as 1980 (Lopatin et al., 1980). The importance of pregnant women receiving oral health care has subsequently been evidenced in the literature, as periodontal disease has been linked to the incidence of diabetes mellitus in mothers (Shangase et al., 2013), and of pre-term and low weight birth rate babies born in mothers with poor oral health (Ercan et al., 2013).

Research existed as early as 2001 to also suggest an association between periodontal disease and chronic obstructive pulmonary disease (Scannapieco & Ho, 2001). Then further evidence surfaced in 2007 that suggested poor oral health resulting in periodontal disease was a critical factor in many medical conditions including diabetes, renal disease, cardiovascular disease and stroke (Mealey & Ocampo, 2007). Periodontal disease was again reported in 2014 as a definite risk factor for cardiovascular disease. The mechanism of the interaction was discovered to be inflammatory responses which induced the production of abnormal cells that could enter the bloodstream and possibly contribute to atherosclerosis. Hypertension was reported to be related to these changes in circulation of oral pathogens which effected the lining of the heart (Macedo-Paizan & Vilela-Martin, 2014). The results from the literature show that periodontal disease may have a significant impact on the overall medical health of rural and remote residents. It is reported that Australians living in very remote areas have a higher incidence of periodontal disease (36.3%) than compared to those living in regional centres (22.1%) (Chrisopoulos et al., 2016). The World Health Assembly resolution in 2007 proposed that oral health care and chronic disease prevention programs should be integrated (Vieira & Caramelli, 2009). A Cochrane Collaboration Review in 2010 was subsequently undertaken and established a definite link between periodontal disease and diabetes (Simpson et al., 2010).

2.7.1 Psycho-social impacts on patients who are unable to access timely dental care

There are documented psycho-social impacts on the lives of those individuals who were unable to readily access oral health care (Cohen et al., 2007; Gary et al., 1994; Gerritsen et al., 2010). Good oral health contributes to the general wellbeing of people as it enables them to eat, speak and socialise without discomfort or embarrassment (Vanobbergen et al., 2010). Toothaches can affect nutrition by making it difficult for an individual to chew and swallow without pain (Cohen et al., 2007; Sheiham, 2006). Poor oral health can also change the way people speak and pronounce words, reduce personal self-esteem, cause people to avoid smiling and showing teeth due to embarrassment, disturb psychological and social wellbeing, alter sleep patterns, impact productivity which may impact on work and social relationships, all of which impact negatively on the individual's general quality of life (Cohen et al., 2007; Gary et al., 1994; Gerritsen et al., 2010).

In 2013, the Australian National Dental Telephone Interview Survey was conducted across 2002-2003 by the Australian Institute of Health and Welfare's Dental Statistics and Research Unit. A total of 7,312 participants were interviewed across all States and Territories in Australia with a 64.8% response rate (Dental Statistics and Research Unit, 2013). It specifically questioned respondents about the social impacts of poor oral health. The survey results highlighted that individuals were mainly concerned about toothache, dental appearance and the pain which caused food avoidance.

The financial burden of dental visits was another major social and emotional impact for people who could not afford these visits. Those who lived in rural and remote locations found that the distances needed to travel for oral health care was a physical barrier to accessing treatment. These people avoided dental visits but perceived their need for oral health provision as great and those people without dental insurance perceived their need for oral health care to be greater than those who could afford private dental insurance (Carter & Stewart, 2003).

The survey also reported the emotional hurdles patients had to overcome before accessing dental treatment. The individuals needed to weigh up the benefits of treatment against the barriers such as time queuing at public dental clinics, the loss of income whilst attending dental appointments and the inconvenience of travel. Other factors were shown to cause concern to remote patients such as the lack of available public dental clinics, the time on waiting lists whilst their oral health deteriorated and the perceived inadequacy of the available dentist's abilities.

These findings were substantiated by a study by Wong and Regan in 2009, that described the mental anguish experienced by people in relation to the distances required to travel to access dental care which demanded "trade-offs" in other life priorities. Factors contributing to this stress in individuals

included the expense of lost time at work to travel long distances, the cost of travel with regards to petrol and wear and tear on cars and the danger of travelling on bad roads when weather conditions were not favourable (Wong & Regan, 2009). Patients have also reported distress in knowing that their dental condition was getting worse the longer that they had to wait for treatment (Carter & Stewart, 2003).

A qualitative study on the emotional effects of untreated dental issues by Cohen and colleagues (Cohen et al., 2007) interviewed 66 participants who had been unable to access oral health care from a dental professional for a toothache in rural towns in the USA. These individuals described their tooth pain as intense, throbbing, miserable, or unbearable. They expressed the effects that this had on their lives as making them unable to perform normal activities including work around the house, group activities, sleeping, speaking and eating. Respondents described depression as a major effect of untreated dental pain (Cohen et al., 2007). Descriptive population studies demonstrate the negative psychological effect that individuals experienced with untreated dental problems (Anderson & Thomas, 2003; Austin et al., 2009; Cohen, Akin, et al., 2009; Cohen et al., 2007; Davis, Deinard, & Maiga, 2010; Pau et al., 2000).

Statistical measures have been developed to quantify the psycho-social impact of dental conditions on patients. These classifications are based on World Health Organization measurements of impairments, disabilities and handicaps. These new classifications measure oral health's impacts on daily living (Kostanjsek, 2011). However, the long term effects of lack of oral health care were not as well documented in the literature, except to report that people developed decreased expectations with time and learnt to cope with difficult situations (Allen, 2003).

2.7.2 Oral Health Education for Non-Dental Primary Care Providers

Non-dental primary health care providers report a lack substantive training in oral health care and consequently often are only able to provide temporary palliative care such as prescriptions for pain killers and antibiotics for dental presentations (Cohen, Harris, et al., 2009; Hocker et al., 2012; McCormick et al., 2013). Very few general medical practitioners in private practice or in hospital emergency departments have received any oral health education in the management of dental problems (Pennycook et al., 1993; Skapetis et al., 2011). A study from the USA in 2010 described how acute dental pain and dental infection were only treated with antibiotics and pain relief by the medical practitioners in emergency departments (Cohen et al., 2011). The underlying dental problem often was not resolved, which resulted in return visits (Davis, Deinard, & Maiga, 2010). The treatment confidence of Australian emergency department doctors in managing dental emergencies was reported by two researchers as varying between *needing improvement* and *good*, depending on

the doctors' levels of experience, seniority and dental triage education (Mansour & Cox, 2006). Pharmacists also reported a lack of education in oral health related issues and expressed their desire for an education component in their training for oral health management techniques (Buxcey et al., 2012). This section of the thesis examines literature surrounding multidisciplinary university education, the challenges to introducing oral health education into existing university curriculum, and the ways to include oral health education in post graduate courses for non-dental primary care providers.

2.7.2.1 *Multidisciplinary university education*

Governments and health professional associations recognise that siloed professional behaviours are not in the best interests of patient care and encourage the education of new medical health care providers to work collaboratively in establishing the best treatment outcomes for patients (Oral Health Monitoring Group, 2015). One solution suggested is to encourage the establishment of mutual interprofessional respect by introducing interdisciplinary education processes at tertiary levels (Stans et al., 2013; Tenenbaum et al., 2008). This interdisciplinary university education may develop a shared understanding of what needs to be communicated and how best to do this in ways that support a more collaborative and holistic approach to oral health care (Gussy et al., 2006). The goal of this type of interdisciplinary education is to better prepare medical practitioners for rural and remote placements where basic dental knowledge of oral health issues would allow better triaging (Wilkinson, 2002). Teaching student medical and allied health care providers to have a collaborative approach to treatment planning gives undergraduate students an understanding of, and respect for, the roles of members of different professions in the health care team (Boyce et al., 2009).

The need for the education of medical practitioners in oral health issues was highlighted in 2000 in a national survey in the USA (Lewis et al., 2000) on the role of paediatricians in the oral health of children. This study surveyed 1600 randomly selected paediatricians from the American Medical Association. Results showed that these doctors believed they had an important role to play in providing guidance on oral health issues and agreed they would have benefited from an oral health education module in their medical undergraduate curriculum (Lewis et al., 2000).

2.7.2.1.1 *Challenges to introducing oral health education to existing non-dental curricula*

In 2006, a literature review conducted by a team of American researchers on the status of interprofessional education in USA universities at the time found only minimal involvement of dental education in interdisciplinary education (Rafter et al., 2006). Interviews were conducted with administrators and academic leaders in seven American medical universities which, at that

time, had schools of dentistry associated with them. Rafter and his associates concluded that the dental schools needed to energetically pursue interprofessional education initiatives and that this could only come about if a designated person was appointed to actively promote and develop interprofessional activities. Funding also needed to be provided for this to occur (Rafter et al., 2006).

It was understood that direction and leadership from dental education facilities would need to be undertaken if dental education using specialised methodologies and systems was to be integrated into medical training (Mouradian et al., 2004). These findings were corroborated by a study in 2012, agreeing that inter-disciplinary education implementation raised concerns in relation to time constraints both within existing university curricula and postgraduate courses, and that financial constraints to implement this interdisciplinary education, contributed to the formation of barriers to this process (Fukushima, 2012).

An Australian study in 2006 explored and identified the confusion that interdisciplinary treatment planning might cause over the assumption of responsibility for the oral health care needs of the patient (Gussy et al., 2006). General practitioners, maternal and child care nurses, paediatricians and dentists were interviewed in regard to their shared concerns for children's oral health. Focus groups and semi- structured interviews were undertaken in four rural communities in Victoria, Australia. The results demonstrated that significant barriers existed between the non-dental health care practitioners and the dentists, and although all groups agreed that the oral health of the children was important, no one professional group would assume ultimate authority or responsibility for the direction of patient care (Gussy et al., 2006).

In an attempt to address these issues, dental interdisciplinary education has now been successfully established at two universities in Queensland, the University of Queensland and James Cook University. An interactive education process occurs in an attempt to break down communication barriers between the health care professions and consequently foster an effective interprofessional learning environment (The Department of Health, 2013). Dental interprofessional education allows the patient's medical health team to understand and appreciate the importance of dental issues for the overall health of their patients (Vieira & Caramelli, 2009).

2.7.2.2 *Post graduate education*

Another means of upskilling the non-dental primary care providers in oral health is the inclusion of dental education modules to improve interdisciplinary corroborations in post graduate courses. A study of Medical Practitioners in the emergency department in a study undertaken in the Glasgow

Royal Infirmary Hospital (Pennycook et al., 1993) reported how their emergency department Medical Practitioners reported poor understanding of oral health issues, and requested specific post graduate courses in basic dental emergency procedures, such as reimplanting an avulsed tooth, the administration of a dental block and arresting bleeding from a tooth socket. The poor understanding that medical practitioners had in the treatment of dental injuries in hospital emergency departments was supported by another study in the UK (Nasr et al., 2013) which suggested that the early diagnosis and appropriate management of dental injuries was essential for a good long-term prognosis of oral health function and aesthetics. Medical practitioners reported having poor knowledge of the management of dental injuries and were interested in attending further education opportunities in the management of dental trauma believing it would improve patient outcomes. A study in 2012 surveyed a group of 103 medical practitioners in the Emergency Department of a UK hospital for the possible benefits of post graduate oral health management education in treating maxillofacial trauma (Trivedy et al., 2012). Most of the participants (76.5%) had not received any formal training in managing dento-facial emergencies and were interested in learning some techniques (Trivedy et al., 2012).

Several studies have focussed their attention on children's dental issues specifically. A study in a Washington DC (USA) paediatric teaching hospital involving child dental health followed the results after the implementation of a basic dental education program for their paediatricians. The goal was to identify dental cavities in their patients and provide referrals. This was a qualitative study with structured interviews of 17 doctors. The results of this study demonstrated that once these doctors had been taught the identifying factors for dental disease, it became the eleventh most common presentation seen in the clinic. Prior to that, it did not appear in the top forty (Graham et al., 2003). Often the paediatrician or the child health nurse was the first health care professional to assess the overall health of the child (Caspary et al., 2008).

In 2008, the American Academy of Paediatrics conducted a randomly sampled national survey which surveyed graduating resident paediatricians about their perceived need for post graduate basic dental education. Although these paediatric registrars saw the utility of offering advice to parents regarding the effects of their children sleeping with a bottle and drinking juice or soft drinks, they were less in favour of providing tasks with a more technical component, and they described the possible lack of clarity in role definition to be as an issue (Caspary et al., 2008).

It was suggested in a series of three studies from Washington University (Mouradian et al., 2003; Mouradian et al., 2004) that medical practitioners should however have some level of oral health education to enable them to screen for oral diseases such as caries, periodontal disease or oral

cancer when assessing the overall medical status of their patients. The study further suggested that dentists should also be able to assess medical health issues such as medications, systemic diseases and behavioural factors in order to be able to provide appropriate and comprehensive dental care. This demonstrated the necessity for information transfer between dental and non-dental health care providers and as a consequence, upskilling of both professional groups to encourage interprofessional relationship building was recommended (Crocombe et al., 2014; Manahan et al., 2011; Mouradian et al., 2003).

Medical practitioners now recognise their need for post graduate education opportunities to allow for increased appreciation of the interrelationships between medical and dental conditions. The findings from a study in 2015 indicated that there was a major gap in knowledge of the links specifically between diabetes mellitus and oral diseases, with 89.6% of the medical group interviewed describing their need for additional education in oral health-related issues (Sede & Ehizele, 2015).

2.7.2.2.1 *Post graduate education formats*

One example of a successful format for a postgraduate education program for non-dental primary care providers was from the USA in 2003, where medical education lectures and interactive sessions with guidelines for preventative oral health interventions, case-based problems, and a kit with resource materials, was implemented. Paediatricians and General Medical Practitioners were trained to provide preventive dental services to low-income children and their care givers. The results from this program showed the effectiveness of preventive dental services and provided non-dental care providers with an increased awareness of those with poor oral health (Rozier et al., 2003).

There is evidence in the literature of the necessity for further education in dental emergency management for Medical Practitioners (Davis, Deinard, & Maïga, 2010). In Australia, primary care providers, including rural and remote practitioners, were offered a short educational workshop in the management of dental emergencies. Six months after the workshop they described the increased confidence they had in managing dental presentations in their practices (Skapetis et al., 2011; Skapetis et al., 2013).

Similarly, in a program targeting Australian Indigenous Health Care Workers in 2001, an education program was piloted to provide preventive care to improve community oral health (Pacza et al., 2001). In another Australian study, an oral health education program for Indigenous children was being delivered by Indigenous health workers in response to high rates of dental

decay in children in Indigenous communities (Blinkhorn et al., 2012), whilst yet another preventative education program was occurring in a remote Indigenous community in the Northern Territory (Slade et al., 2011). These programs all raised the awareness for the importance oral health literacy in those rural and remote communities, which essentially begins the interprofessional communication process between oral health care practitioners and non-dental primary care providers.

Pharmacists also described that they were frustrated by the lack of sufficient postgraduate education resources for their upskilling in the management of dental presentations. They agreed that this would encourage collaboration with, and timely referrals to, oral health care practitioners (Dickinson et al., 1995; Maunder & Landes, 2005). A lack of training and resources relating to oral health and systemic disease was further substantiated by a study in 2012 which reported the limited interprofessional education opportunities for pharmacists (Buxcey et al., 2012). Rural pharmacists in yet another study were concerned about their lack of oral health education and their exclusion from the holistic management of patient care (Maunder & Landes, 2005).

A study from the UK reported that most interactions in pharmacies took place with pharmacy assistants rather than pharmacists, suggesting a greater role for these counter assistants in oral health promotion strategies (Steel & Wharton, 2011).

Despite the recognised need for changes to university education to encourage interprofessional collaboration between dental care providers and non-dental rural primary care providers, there are still many dental and non-dental health care practitioners who exhibit siloed attitudes to professional practices (Bissett et al., 2013; Oral Health Monitoring Group, 2015). The literature was examined for evidence of what other factors influence the development of interprofessional relationships between oral health care practitioners and different members of the non-dental primary care networks.

2.7.3 Nature of interprofessional collaborations

Many patients with co-existing dental and medical issues such as the elderly or individuals with disabilities, necessitate a multidirectional health care plan that requires the co-operation of both medical and dental professions (Andersson et al., 2007). This process of interprofessional collaboration, where different professional disciplines work together to improve the quality of patient-centred care (Valle-Oseguera & Boyce, 2015) may have an impact on patient outcomes (Mouradian et al., 2004). The National Oral Health Plan 2015-2024 in Australia aimed to encourage a better relationship across the health professions (Oral Health Monitoring Group, 2015) using a

collaborative approach to increase the promotion of oral health by: doctors, child health nurses, pharmacists, community nurses, teachers, aged care providers, physiotherapists, speech pathologists, community services, the media, the education sector, employer bodies and workplaces and, the communities themselves (National Advisory Council on Dental Health, 2012). The expected outcome from this collaborative approach was predicted to be better communication between the rural primary care network and dental practitioners thus providing enhanced patient centred results (Retchin & Sheldon, 2008).

2.7.3.1 *Collaborations with medical practitioners*

In 2012, a study that examined the relationship between dentists and doctors in relation to diabetic care was conducted in North East England using interviews that were audio recorded and then transcribed (Bissett et al., 2013). Four medical practitioners, five allied medical diabetic carers, four dental professionals and four patients with diabetes were interviewed. The result of this study demonstrated the divisions that existed between oral health and medical health care providers. There was isolation of knowledge and siloed behaviours between the two groups showing poor understanding of the interconnectedness of diabetes and periodontal disease. This study observed that professional tensions between medical practitioners and oral health care practitioners contributed to the lack of comprehensive care given to diabetic patients (Bissett et al., 2013). Another study showed that to avoid these tensions a patient advocate is often appointed to initiate collaboration between doctors, dentists and other allied health professionals, in order to achieve the best patient outcomes (Mouradian et al., 2003). Time constraints in relation to the high workload of both dental and non-dental health care providers, created emotional pressures creating a significant barrier to the establishment of effective collaborations between dentists and doctors (Lewis et al., 2013).

Interest in the sharing of patient medical files and in health networking between medical and dental practitioners was explored as a gauge for levels of interprofessional collaboration in a French study (Tenenbaum et al., 2008). A survey of 13 dental practitioners and 12 medical practitioners was conducted via a questionnaire concerning the relationships they had with each other. Both groups had very different views on the relationship status that they had with each other. The dentists rated their relationship with the doctors as good or excellent and had no wish to change it, whilst the doctors rated their relationship with the dentists as non-existent and wanted to improve it. This study placed the blame for lack of communication on the medical profession. It concluded that doctors needed to be made more aware of the other health networks and of how to share medical information with dentists. The authors of this study concluded that medical education and training must involve interdisciplinary collaborative approaches to health care (Tenenbaum et al., 2008).

This previous study lead the way for a more recent American study in Michigan (USA) which also used the sharing of patient medical files between dental and medical practitioners to gauge patient care and to also understand the nature of interprofessional communications (Patel et al., 2012). A survey was taken of all the members of the Michigan Dental Association and the members of the American Association of Radiation Oncology in Michigan, which examined the barriers to recommended cancer patient care. Eighty-one percent of dentists perceived a communication barrier with the oncologists as they reported being given insufficient time to complete dental work for the patient before the onset of oncology treatment. Both professional groups reported a lack of understanding of the role played by each other in the overall treatment planning for the patient and both groups expressed interest in further education options to decrease these barriers. The inadequate collaboration and communication between a patient's health care team members contributed to discrepancies in the application of patient care protocols (Patel et al., 2012). Dry mouth as a result of radiation to the head and neck region is a dento-medical associated complication that is reported also in an earlier study (Slavkin & Baum, 2000).

Interprofessional collaboration between dental practitioners and physicians have been shown in the literature to cause a direct benefit for patient outcomes. A case study in New York, described co-operation and communication between a dentist and a specialist physician in the treatment of a 45 year old patient with Parkinson's disease. The patient required dentures to increase his quality of life and to allow eating to improve his overall medical health. The patient was treated by the dentist in the operating rooms of the treating hospital and the treatment times were co-ordinated with the medication administration times as advised by the medical practitioner (Katyayan et al., 2013).

Similarly, another example in the literature of co-operation between a team of medical specialists and a dental practitioner was reported from a case study at Hiroshima Hospital in 2012. A patient had suffered severe facial trauma and required intubation but access was impossible and the subsequent interprofessional communications between medical and dental practitioners provided a mouthguard design that combined the skills of both professions for the benefit of the patient (Fukushima, 2012). This study concluded that interprofessional cooperation between the medical and dental practitioners was indispensable for better patient outcomes.

2.7.3.2 *Collaborations with pharmacists*

Studies involving the relationships between pharmacists and dental practitioners were also limited in number. Jacobsen & Lofholm (2008) interviewed pharmacists from the Californian Pharmacists Association (USA) to explore their relationships with dental practitioners. The main interaction between pharmacists and dentists was reported in relation to the dispensing of scripts that had

been written by dentists. The pharmacists described the necessity for a good working relationship between the two professional groups because they were the ones dispensing the prescribed drugs. If a prescription written by a dentist contained errors, either administrative or clinical, then the pharmacist was legally obliged to ensure the safe supply of the medication. Pharmacists in ensuring this public safety role felt that they might potentially create animosity between the two professions when they refused to fill a script that was incorrectly written by a dentist. Approximately 400 pharmaceutical agents prescribed by general medical practitioners and consequently dispensed by pharmacists can cause a dry mouth. This poses major challenges to good oral health and pharmacists felt they had a role in educating and informing patients of this problem (Slavkin & Baum, 2000).

Pharmacists reported that they were also usually aware of particular patients in the community who might be abusing the medical system by trying to obtain prescription medications from multiple suppliers and they suggested that dentists may be targeted by these individuals also (Jacobsen & Lofholm, 2008). The role for pharmacists as oral health educators in collaboration with dental practitioners was corroborated by a study in 2005 which described the vital role played by these non-dental health care providers in oral health triage by the distribution of oral health brochures to patients, displaying oral health posters in their stores, offering advice on medications in relation to oral health issues and offering advice in relation to oral health care product choices (Cohen. L, 2009; Maunder & Landes, 2005).

2.7.3.3 *Collaborations with other allied health care providers*

The interprofessional collaborations between dental practitioners and other allied health care providers have been explored in literature. It has been suggested that a role might be played by rural maternal community and child care nurses. The health care providers could potentially educate children on oral health care at playgrounds and schools and even deliver oral health intervention programs by promoting early exposure to fluoridated toothpaste and distributing an oral health starter kit to parents of preschool children (Neumann et al., 2011).

The occupational therapist (OT) and oral hygienist relationship was explored in a study (Strzelecki, 2010) by a researcher in the Department of Occupational Therapy at the University of Mississippi Medical Centre (USA). This study described the problems that existed in transferring dental patients with physical handicaps to dental chairs and advocated the teaching by OTs to dental hygienists of different techniques in patient handling (Strzelecki, 2010). Strzelecki recommended the introduction of an interdisciplinary education module between oral hygienists and OTs.

2.7.4 Referral pathways

Interprofessional relationships may be better understood by examining the referral pathways used for patients between primary care providers and dental practitioners. The establishment and maintenance of a reliable referral pathway would help build interprofessional confidence in more effectively managing oral health problems (Dyson et al., 2012).

A study in the USA in 2002, reported that the purpose of screening by nondental personnel generally was to identify the priority required for dental referral. The study found that it only took around two hours of training for paediatric primary health care providers to be competent in performing oral screenings which would enable effective triage before referral (Pierce et al., 2002). However, another American study examining oral health issues in a Washington DC Hospital, demonstrated that the treating paediatrician interviewed could not see the practicality in taking the time to screen for a diagnosis of dental issues, because a referral to a dentist was inevitably the only long term solution to a dental issue that a doctor could provide. They did not see any value in diagnosis or triage as they did not have the dental equipment or the training to treat complicated dental issues. Workforce shortages, lack of funding to do the triaging and lack of role definition were barriers to this concept and it was postulated that the identification of undiagnosed dental issues by medical practitioners would exacerbate an already over stretched health service (Graham et al., 2003).

Similarly, in an Indian study, time constraints placed on busy medical practitioners were reported as an issue in triage and subsequent referral for dental issues. The knowledge that randomly selected doctors had about periodontal disease was explored using a cross-sectional survey. The medical practitioners all knew that the disease could lead to medical problems, but only 10% of those doctors would refer their patients with periodontal disease to a dentist, demonstrating poor interprofessional collaboration (Nagarakanti et al., 2013).

More recently receptionists for a public emergency dental service in a Tasmanian study, were trained to manage a computer-based telephone triage system for emergency dental care, to facilitate timely dental referrals. All callers were asked questions regarding their presenting dental complaint. The computer analysed the severity of the dental issue from patient responses to specific questions and referral priority for a dental appointment was effectively triaged (Ponnusamy et al., 2013). The conclusion was that this was an effective triage method for patient self-referral but did little to encourage interprofessional relationship building.

Another strategy for identifying oral health care issues in individuals was reported in rural USA in 2012. The use of school-based health professionals such as school nurses, rather than overloaded General Medical Practitioners, in order to enable the earlier detection of dental problems in children

and prompt referral to an oral health practitioner were identified to be of benefit to children. Better oral health for children would be a result of a more effective utilisation of existing heath care providers in an interprofessional approach (Lam et al., 2012). Similarly, a simple oral health screening program for non-dental primary care providers called "*Lift the Lip*" has been a strategy to encourage interprofessional collaboration for the benefit of the patient (Metro South Health, 2017). The purpose of this program was to identify pre-school children needing a referral to a dentist and to provide an oral screening test for the elderly, as part of their wellness check (Slade, 2007)

The evidence of instances of effective interprofessional communications, collaborations, interdisciplinary educations, referral pathways and thus "relationship" in the literature were difficult to find, suggesting that this is an area within the literature that is poorly reported and justifies the necessity for a specific relationship study between oral and non-oral medical care providers to be undertaken.

2.8 Teledentistry

The use of new technologies such as telecommunication technologies, digital imaging and the internet has allowed the formation of teledentistry as a subset of telemedicine. Teledentistry is the effective utilisation of imagery technology and the internet (Chang et al., 2003) which allows images and clinical information to be transmitted via the internet from a remote location, for dental consultation and treatment planning by a dental practitioner in a different location (Khan & Omar, 2013). This technology has applications that may aid in the early diagnosis of oral disease, facilitate timely treatment and offer improved access to oral health care (Mariño et al., 2014). This study explores a further underutilised application for the technology to possibly enhance interprofessional collaboration between dental and non-dental health care providers. It has been suggested that this may have the potential to lower the costs for patients in accessing rural and remote oral health services (Elliott-Smith & Hovliaras-Delozier, 2007; Jampani et al., 2011).

The potential for teledentistry to enhance interprofessional communication between General Medical Practitioners and remotely located dental practitioners has been suggested as a way to improve collaborative care for rural and remote dental patients (Khan & Omar, 2013). This was supported by the view that teledentistry would alleviate some of the issues related to rural and remote oral health care such as dental personnel workforce shortages (Daniel & Kumar, 2014) and the costs and emotional burdens for patients of travel to regional centres for dental care (Khan & Omar, 2013). Alternatively, it has been suggested that remotely placed dental auxiliary care providers with proper scope of practice qualifications may be able to utilise teledentistry as a

mechanism to collaborate with dental practitioners in more regional centres (Estai, Kruger, & Tennant, 2016b).

2.8.1 The evolution of teledentistry

The first teledentistry project reported was by the US Military in 1994. Teledentistry was utilised to serve troops and their dependants in remote parts of the world. Dentists within the armed forces, were able to consult quickly with off-site specialists for remote diagnosis and planning of interventions for dental problems. Other applications for teledentistry in this project included dentist-laboratory communications and continuing education for army dentists. The results of this project confirmed that a more efficient referral system could be maintained with teledentistry than with traditional formats and that the cost effectiveness of this mode of oral health care delivery was substantial (Chang et al., 2003; Fricton & Chen, 2009; Rocca et al., 1999).

An early literature review from 1999 into the worldwide use of teledentistry reported the potential for remote dental consultations which could possibly improve diagnosis and treatment of oral health issues (Rocca et al., 1999). In 2001, teledentistry applications were being reported in other studies around the world as suitable mechanisms for enhancing interprofessional communications between dentists, or between dentists and dental specialists (Yoshinaga, 2001).

The terms “teleconsultations” or “cyber-consultations” with specialists was first penned by Chen & Fricton, 2007. Remote consultations would make it possible for specialists to provide a diagnosis and work through treatment options with the referring dentist or the patient remotely (Chen & Fricton, 2007). Research showed that many dental specialists already utilised web sites to gather referrals from dentists. Specialised referral forms were provided, and the specialist responded with confidential replies almost instantaneously thereby enabling efficient time management (Clark, 2000). Particular specialist areas in dentistry were discovered to already be using teledentistry in some format including: web-based referrals for orthodontists (Hobson, 2002; Mandall et al., 2005; Stephens & Cook, 2002; Stephens et al., 2002), endodontists (Avula, 2015; Brullmann et al., 2011), oral surgeons (Duka et al., 2009) and periodontists (Ojima et al., 2003).

In a developing country such as Turkey, the majority of the dental professionals who participated in an online survey stated that the use of teledentistry was favourable to monitor patients, remote consultation, and education (Ata & Ozkan, 2009). In Udaipur (India) there was reported to be limited awareness of teledentistry and its applications, suggesting that educational programmes for dental practitioners might fill the knowledge gaps and encourage positive attitudes to these new technologies (Ramesh et al., 2013).

In the UK, teledentistry was analysed for the feasibility of its applications. It was concluded that the technology required the dental and non-dental health care providers to fully comprehend the uses of the technology and for the political bodies within the UK to also commit completely to the integration of teledentistry to dental services (Patel & Antonarakis, 2013). More recent systematic reviews in 2013 confirmed what was originally suspected in 1999, that a consistent trend in the literature supported the effectiveness of teledentistry (Daniel et al., 2013; Mariño & Ghanim, 2013). Other documented uses of teledentistry were being reported such as patient education, detection of early caries, oral medicine diagnosis and preventative dentistry (Khan & Omar, 2013).

However, a systematic review of the literature in 2015 (Ines Meurer et al., 2015) indicated that the uses for teledentistry have increased worldwide but it is still underutilised by dental practitioners due to barriers such as the lack of understanding of the technology and its potential uses. In contrast to the Indian study examined earlier from 2013, it was demonstrated in an Indian study in 2015 that the potential of teledentistry was being recognised as a mechanism to help rural and remote dental patients access remote dental consultations. Unfortunately, the dental practitioners were lacking in sufficient knowledge and awareness of teledentistry applications to embrace the technology (Boringi et al., 2015).

In 2016, the acceptance for the successful uses of teledentistry was recognised with a systematic literature review being conducted on the acceptance of teledentistry and of the diagnostic accuracy of teledentistry. This study reported the very acceptable diagnostic performance that teledentistry diagnosis had in the detection of dental caries. (Estai, Bunt, et al., 2016). The South Carolina Dental Association members in the USA were asked about their knowledge, need and interest in using teledentistry to allow improvements in accessing timely oral health care for patients. They responded that they were unsure if the workforce availability in rural and remote communities was in balance with the time required for the operators to utilise the equipment needed for teledentistry and were further unsure if the demand for, and interest in, teledentistry would be sufficient to make the technology worthwhile (Martin et al., 2016).

A systematic search of the literature was again undertaken in 2017 and 39 studies were included that focused on the effectiveness of teledentistry projects currently in practice. The conclusions from this review were that there is now a generalised acceptance amongst clinicians and patients of the value for teledentistry for remote, consultation, diagnosis, and professional mentoring in dentistry. Information and communication technologies are developing rapidly allowing improvements in diagnostic accuracy and in cost effectiveness (Irving et al., 2017). Another systematic review in 2017 also concluded that there is emerging evidence to support the

effectiveness of teledentistry, but that there is not yet enough definite evidence for its cost-effectiveness (Estai, Kanagasingam, Tennant, et al., 2017).

In particular, Canadian orthodontists generally felt that the use of teledentistry in a variety of applications might prove useful in improving the way they practiced orthodontics, however they described concerns in relation to the cost of the technology, data security, patient privacy and the time required to engage the technologies (Palmer, 2004). Dental practitioners in West Yorkshire (UK) were also undecided as to the benefits of teledentistry for orthodontic referral services because they were they were unsure of their own information technology skill levels (Bradley et al., 2007).

In the Mid-Western USA dental practitioners, dental students and medical practitioners were offered a training session in teledentistry screening techniques, and subsequently reported the positive impact this training had on their acceptance of the uses for teledentistry (Nayar et al., 2017).

Australian dental practitioners generally reported optimism and support for the concept of teledentistry and its integration into dental practices (Estai, Kruger, & Tennant, 2016a; Mariño et al., 2014). Research examining different teledentistry applications found that there was little active teledentistry practice in Australia (Estai, Kanagasingam, Xiao, et al., 2017; Estai, Kruger, Tennant, et al., 2016). This research project will explore another area of teledentistry for which there is limited research. The interest will be assessed of General Medical Practitioners and other allied health care providers, for the introduction of intraoral cameras into medical practice or allied health practice to improve management of dental issues.

2.8.2 Population groups to benefit from teledentistry

Fricton and Chen suggested that the integration of teledentistry technologies into oral health care would encourage patients to seek dental advice where they previously might not have sought it (Fricton & Chen, 2009). People with complex medical conditions, coupled often with physical and with mobility issues, those with special needs, and those with psychological issues may not be able to access oral health care easily and teledentistry may increase such access (Glassman et al., 2016).

It has been suggested that underserviced communities would benefit from the introduction of remote consultations as offered by the utilisation of teledentistry technologies (Birnbach, 2000; Cooper & Engeswick, 2007). A Queensland study in 2016 examined Indigenous communities in relation to potentially preventable hospitalisations for medical conditions of dental origin. The study concluded that the use of teledentistry might enable Indigenous Health Care Workers to provide preventative oral health care and education and avoid these hospitalisations (Caffery et al., 2016).

Elderly, frail, and dependent populations are often in great need of timely oral health care provision, but access issues among elderly residents of long-term care facilities means that dental neglect and high levels of unmet dental needs are becoming commonplace (Philip et al., 2012). The feasibility of using teledentistry to deliver this care in nursing homes was examined in France in 2014, and the conclusion was that teledentistry was rarely utilised, but that dental teleconsultations should be introduced as an aid when screening all new nursing home admissions (Giraudeau et al., 2014).

In Australia, almost 10% of the 1.1 million hospitalisations from 2008-2009 were for older people living in residential aged care facilities (Australian Institute of Health and Welfare, 2013). One Australian study showed that teledentistry for oral health screening is a reliable alternative to traditional oral health examination in these residential aged care facilities (Mariño et al., 2015). This was corroborated by a German study in 2017, which also showed effective dental pathology diagnosis via teledentistry consultations for elderly adults living in nursing homes. This study further concluded that the technology may allow dental professionals to do regular check-ups, which is a part of an effective preventative oral health care plan (Queyroux et al., 2017).

A French study in which prisoners had regular dental examinations, recognised the inter-connections between medical, dental and emotional health. The utilisation of an oral teleconsultation with teledentistry was suggested as a way to service prison populations in an effective manner (Giraudeau et al., 2017). Another study from Brazil in 2014 also assessed teledentistry as a viable option to screen for dental caries in Brazilian juvenile offenders. It concluded that the good reliability of tele-consultation for dental caries screening, made it a reliable alternative to traditional face to face oral examinations (Morosini et al., 2014).

Socially underprivileged children have poor access to orthodontic services and consequently one study examined the feasibility of using teledentistry to provide real-time supervision from a specialist orthodontist of a general dental practitioner providing orthodontic care to these children. The results suggested that this was a viable approach for children who otherwise would suffer from untreated malocclusions through to adulthood (Berndt et al., 2008).

2.8.3 Internet requirements for teledentistry

The basic requirements for a teledentistry workstation are: a laptop, a digital camera and high-speed internet access (Alipour-Rocca et al., 1999). The original application for teledentistry was for the referral by a local dentist to a dental specialist at a different location. The procedure required the local dentist to log into a secure web server, and send an email with the patient's details, dental problem, provisional diagnosis, and attached dental radiographs, to the specialist via a database server. The specialist would receive an email saying that the data is in the secure database server

and at a time convenient to the specialist they would be able to log into the secure web server and review the referral and radiographs, and then call or email the local dentist to suggest a diagnosis and treatment plan (Alipour-Rocca et al., 1999).

Advances in modern telecommunication networks and the internet worldwide have enabled an increase in data transfer when compared to previous years, which forms the backbone of modern teledentistry (Milosavljević & Čurović, 2012). In Australia in 2012, a typical home internet connection provided six megabits per second (6mbps), which allowed the ability to stream television programs and surf the web, but the video conferencing capacities required for teledentistry applications were insufficient (Marino et al., 2012). Typically, a 15 minute remote examination using an intraoral camera on high-resolution video uses about 1 GB of data per minute and the previous ADSL data speeds meant that such a file would take hours to stream to the specialist via online channels and consequently, a 15-minute examination would take all day to send (Sheedy, 2013).

The National Broadband Network (NBN) is a national telecommunications infrastructure project which is designed to meet the rapidly expanding demand for internet access across the whole of Australia and will replace the aging existing telephone network copper cables. In 2017, the NBN incorporates both wired and radio communications along existing exchanges, typically located in Telstra owned exchanges, and is expected to create faster internet download speeds of up to 25mbps and upload speeds of 5mbps which will make connections easier and the transfer of files almost instantaneous (Sheedy, 2013). The previous Telstra satellite service offered a much slower, 6mbps download and 1mbps upload. Dial-up services that are still often the only option for many rural internet users today peak at 54 kilobits per second (kbps) (Nirmalathas, 2015).

The NBN has two specifically designed satellites (Sky Muster NBN-1A and Sky Muster NBN-1B) based on Space Systems/Loral's 1300 Series Satellite Platform currently in operation and a third satellite will be launched later in 2021. The satellites are placed in a geosynchronous Earth orbit 36,000km above the equator. (Chobotov, 2002). The signals from Earth to the satellite use a specific band frequency and are transmitted at 27GHz to 31GHz. The signals back from the satellite to the Earth use another specific band frequency between 17.7GHz to 22GHz, which will enable fast downloads. There are however problems with this wireless system such as the large number of users per spot beam (signal) and signal inconsistencies due to atmospheric conditions (Nirmalathas, 2015).

The time taken for the radio wave signals to make the trip from Earth to satellite and back again can take up to a second which is a substantial lag and will affect the ability for teledentistry to operate effectively. Consequently, internet service providers in Australia are working to improve this situation and new global satellite companies such as One Web and Space X, will launch a series of

satellites positioned in low Earth orbits that will boost the speed towards 50mbps as well as reduce lag times. (Nirmalathas, 2015).

The practice of using teledentistry to aid in remote dental consultations, diagnosis, treatment planning and/or follow up consultations, may occur in two different ways either "time delayed" or "real-time" consultations (Chen & Fricton, 2007).

2.8.3.1 *Time-delayed/store-and-forward teledentistry*

"Store-and-forward" technology is particularly useful as it allows the costs for connectivity and equipment to be minimised (Estai, Kanagasingam, Xiao, et al., 2016). The image is captured using an intraoral or other digital camera and then stored on a computer with specific capabilities which include: a substantial hard drive memory, adequate RAM, and a speedy processor. To forward the image to the remotely located dental practitioner it would be necessary to have a modem and a suitably powerful and reliable Internet connection where large video files could be uploaded for review at a later date (Birnbach, 2000; Chang et al., 2003). Videoconferencing either real time or "store-and-forward" was seen as a form of teledentistry to enhance dental communications (Elliott-Smith & Hovliaras-Delozier, 2007).

2.8.3.2 *"Real-time" teledentistry*

Real-time communication streaming was considered an impossibility only 10 years ago, and to enable live videoconferencing in combination with the use of an intraoral camera, it was necessary at that time to install a PCI codec board into the system or to use a standalone IP/ISDN. If a live group session was to occur ,which might connect three or more parties, a multipoint control unit was needed and the codec had to be able to lodge audio and visual functions (Folke, 2001).

However, the arrival of the NBN and its necessary modifications to decrease latency (lag times) and advances in innovative dental technologies means real-time teledentistry is expected to become alot easier and simpler in the future. A more modern way to allow this real-time video link communication is to use a File Transfer Protocol service where the real-time video is streamed using a VideoLan client/server application. The images are streamed from an intraoral camera using HTML5 web-pages generated by PHP (Gambino et al., 2014). A study in 2014 also re-emphasised the value of using pure HTML5 to ensure the portability of the intraoral camera which enables linkage to any laptop with a modern web browser and internet connection (Puel et al., 2014). Fast broadband speeds are important to overcome any latency, or lag issues with videos of patients' mouths and, as the NBN is rolled out over Australia, the potential for teledentistry will expand (Clarke, 2015). Real-time teledentistry consultations could potentially achieve better outcomes than store-forward consultations, due to instantenous two-way communication (Mariño et al., 2016).

Two separate studies, one from the Philippines (Walker et al., 2017) and one from India (Karat et al., 2015) on the feasibility of using teledentistry concluded that the unaffordability of devices with cameras and the poor internet coverage in most rural and remote communities in the developing world, coupled with privacy issues dictated that these countries would not be able to rely on the electronic follow-up of patients.

2.8.3.3 *Digital Dental Images*

Dental images are taken and transferred in three main ways: intraoral cameras and telecommunication pathways, extraoral digital cameras and radiographs which are attached to emails, and mobile phone camera images which are sent via mobile phone telecommunication pathways. The accuracy of diagnosis for children and teenagers using dental images compared to real life examinations has been explored in a review of the literature in 2015. The results showed image analysis to be either superior or comparable to the diagnosis of the same conditions done by direct examination in a face-to-face situation. There was however a wide variation in equipment types used and the training levels of personnel employed for the collection and interpretation of the photographic images, which made it unclear as to exactly how effective store-and-forward teledentistry is for the diagnosis of common dental conditions in children and teenagers (Ines Meurer et al., 2015). Enhancing dental images with scattering and fluorescence based optical caries detection methods, has not been shown to make diagnosis any clearer than by using an unadulterated digital image attained (Jones, 2015).

2.8.3.3.1 *Intraoral cameras*

Intraoral cameras are small networkable cameras that are placed inside a patient's mouth to take magnified images and videos of teeth and oral structures. The development of new technologies in image taking has allowed dentists to diagnose dental problems more accurately from digital images.

In 1996 when intraoral camera technology was a new concept, a survey conducted by the Seltzer Institute in British Columbia (USA) reported that this technology was promising but underutilised (McLeod, 1996). Twelve years later a Brazilian pilot study utilising intraoral cameras in combination with digital radiography, concluded that this technology would be of great benefit for the remote diagnoses in primary care public health clinics (Torres-Pereira et al., 2008). A study from Saudi Arabia in 2017 described the effectiveness and reliability of intraoral cameras using teledentistry in oral health screening and has shown that these devices can be a reliable tool for the evaluation of common oral conditions such as caries, calculus, tooth wear and fluorosis in children (Pentapati et al., 2017).

2.8.3.3.2 *Extra-oral cameras taking digital photos and attaching them in emails*

The simplicity and speed of digital imaging which delivers accuracy in reproduction of colour, sharpness of image, accuracy in depth of field and the high overall image quality, has enabled reliable diagnostic reproduction in teledentistry (Ford, 2003). Remotely located oral health care practitioners have electronically transmitted digital x-ray photographs and drawings, for analysis to another dentist, doctor or dental specialist in a different location (Clark, 2000; Eraso et al., 1996). Access and delivery of oral health care has been shown to improve by utilising digital photos and emailing them for remote diagnosis allowing for the disparities that exist between dental care in remote and urban regions to potentially be minimised (Amavel et al., 2009; Jampani et al., 2011). However, the applications for teledentistry were still reportedly misunderstood and underutilised (Mariño & Ghanim, 2013).

The feasibility of the distance diagnosis of oral health issues, using digital images transmitted by email was examined again in a study in Paraná in Southern Brazil in 2008. The results from this study confirmed that patients may benefit from the use of email and digital cameras for teledentistry in remote areas where dental specialists are not available (Torres-Pereira et al., 2013; Torres-Pereira et al., 2008).

2.8.3.3.3 *Mobile phone devices- Smartphones*

The feasibility of using a mobile phone to acquire quality images for remote diagnosis of medical issues, telemedicine, was first examined in a study in 2013. This study examined images of skin for skin cancer diagnosis (Condominas, 2013) and the widespread acceptance by the speciality of dermatology and their patients for smartphone photography was reported. The next step for teledentistry was to also simplfy the process of image transmission by examining the possibility of using smartphone dental images for remote dental diagnosis, and consequently a study was undertaken in 2016 to evaluate if a cloud-based telemedicine application might be manipulated for the screening of oral diseases (Estai, Kanagasingam, Huang, et al., 2017). A store-and-forward method was the basis for this telemedicine system, and the dental adaptation was to discover if this system might also cope with storing oral images and the demographic patient details to accompany these images (Estai, Kanagasingam, Xiao, et al., 2016). These images were directly uploaded from the smartphone to a cloud-based server via broadband network. The trial was successful and opened the field for further development of dental mobile phone applications (apps).

A further study in 2017 by the same authors built on the results of the previous one and uncovered some areas that needed addressing such as the need to correctly orientate and crop the images and the necessity to use oral cheek retractors during photography to give maximum image quality. It was concluded that smartphone camera features need optimization with macro-lenses and the format of the server needed to be improved. The success of teledentistry into the future was reliant on more effective coordination between the communicating sites, upgrading the dental phone apps and more specialised training for the image takers (Estai, Kanagasingam, Huang, et al., 2017).

The high-quality and resolution of photographs from modern smartphones allows these devices to be used as a viable tool for remote diagnosis of dental issues such as traumatic dental injuries (de Almeida Geraldino et al., 2017), dental caries (Estai, Kanagasingam, Huang, et al., 2016) and malignant lesions of the oral mucosa (Haron et al., 2017). These authors all concluded that the precision of remote diagnoses and "in person" diagnosis, for both dental issues, were comparable. They independently suggested that telemedicine and mobile phone technology can be combined to create an inexpensive and reliable screening tool with applications to teledentistry.

Saudi Arabia recently experimented with a different teledentistry application by creating a preventative oral health educational app for mobile phones called "*iTeethey*" to teach techniques of preventative oral care to children and their parents. The mobile phone usage is reported to be very high in Saudi Arabia and consequently this mobile phone-based app was made freely available in the App Store for iphones and in Google Play for Android phones. The results from the study showed that the use of this specialised dental education app significantly improved mothers' knowledge of the requirements for their children's good oral health (Alklayb et al., 2017).

2.8.4 Ethical and security based considerations for teledentistry

In 2000, Clark first described the possible pitfalls of teledentistry where consulting experts were to decide on a time-based fee for service. His concern was that dentists might send photographs, x-rays and diagrams directly to a specialist and set up internet patient appointments without a physical consultation. Verbal descriptions of symptoms by patients along with the poking and prodding of the teeth, are a large part of the dental disease diagnostic process. The difficulty with teledentistry is the loss of this interpersonal communication between patient and dentist. Photographs and images alone may mislead a diagnosis and it was suggested by Clarke that this type of remote dentistry would not be in the best interests of the public in all cases (Clark, 2000).

Aside from these ethical dental practice dilemmas, legal problems are also reported in the literature. As early as 1999 it was reported that due to the ease of accessing web-based patient records, traditional barriers to exchanging information were falling. Sophisticated security mechanisms attempted to ensure confidentiality of patient information, but the web was not developed as a programming environment and the technologies underlying the web are constantly evolving, compelling designers to endlessly reengineer their systems (Schleyer & Rao Dasari, 1999). Maintaining patient health information in an electronic form also poses risks and potential ethical dilemmas (Cederberg & Valenza, 2012).

Several challenges associated with privacy and security compliance were identified in America in 1996 and included resistance from both patients and employees regarding this compliance, the high cost of compliance requirements, the technology associated with these requirements, and the difficulty of remaining compliant with a rapidly changing regulatory environment. The perceived effects of the implementation of legal teledentistry requirements in the United States of America included the reinforcement of patient privacy and security acts and the difficulty amongst older practitioners of transitioning from paper-based to electronic health records (Henson, 2016). Current licensure laws in the USA may make it more difficult to implement teledentistry and a survey in 2016 suggested that many oral and maxillofacial radiologists in America may be practicing without a license. Diagnostic photos, x-rays and images are essentially portable which consequently may make it more difficult to enforce practice boundaries geographically. A national licensure system would be easier to enforce while maintaining high levels of patient safety (Simon & Friedland, 2016).

Another use for teledentistry is for the medico-legal establishment of human identification using forensic odontology. Cases of investigations of criminal activity where unidentified human remains or bitemarks are found may utilise these technologies. If dental records were readily available in the cloud then in cases of mass human casualties, the identification of the remains would be more easily facilitated. Teledentistry could change the way that forensic odontologists collect, interpret, organize, and document evidence in their professional practice to identify human remains (Williams & Bradshaw, 2015).

To ensure patient privacy, the utmost care must be taken by teledentistry users to make sure that unauthorised entities do not access information, but patients should also be informed that despite the maximum efforts to maintain security, the electronic transfer and storage of their personal information may potentially be intercepted (Chang et al., 2003). These concerns about the confidentiality of dental information often arise in relation to the electronic transfer of dental records and medical histories, as well as from the general security problems associated with

electronic data stored in computers (Sfikas, 1997) and written informed consent for the use of teledentistry must be obtained. The patient should further be informed of the inherent risks associated with teledentistry in relation to the possible failure of the technology and the incorrect diagnosis that might occur due to this technological failure (Golder & Brennan, 2000).

There are inherent inconsistencies in the privacy and security of teledentistry, its quality and safety, as well as remuneration, financial and taxation issues. In addition, many of the legal issues such as malpractice, copyright, licensure and jurisdiction issues have not been addressed by the relevant legislative bodies, nor have any definitive judgements been passed (Chang et al., 2003; Golder & Brennan, 2000; Sanders et al., 2006; Wallace, 2001). Currently, teledentistry is still not a well utilised part of dental health care due to the original issues of financial reimbursement, privacy, security, regulatory and legal sanction, and the situation is now been further complicated by issues relating to compatibility and interoperability of the technology across different computer platform systems, and by the differing acceptance by patients and providers alike of teledentistry (Seth et al., 2017).

It is important that as the availability of teledentistry increases as an acceptable practice medium for remote oral health care access, dental practitioners must learn the legal, technological, and ethical requirements that are a part of this new era in dentistry (Golder & Brennan, 2000).

2.8.5 Cost saving with teledentistry

A study in 2017 compared the costs of traditional dental screening and teledentistry and concluded that teledentistry is an economically viable approach for remote dental screening for isolated and/or underserviced communities. The main reason for the cost savings were the lower salaries of auxiliary staff such as dental hygienists and therapists when compared to dentists (the dental hygienists and therapists are able to take the images that are then remotely diagnosed by the dentist). Further savings were made as teledentistry meant that patients could avoid travel and overnight accommodation costs (Estai, Bunt, et al., 2017). Another study in 2013 determined that there was no significant variance in clinical teledentistry methods of screening for dental caries by either dental practitioners or dental hygienists (Daniel, 2013).

2.8.6 Teledentistry for education

A literature review published in 1999 into the use of teledentistry worldwide suggested that the most common use of teledentistry was for education (Rocca et al., 1999). In 2016, it played an important role in continuing professional postgraduate development programs for dental practitioners as well as in the undergraduate education for dental students (Jain, 2016). Indian dentists in remote areas had used teledentistry for delivery of postgraduate education to themselves

(Chhabra et al., 2012). Educational challenges towards the ethical obligations of patient data security by using this technology must be met (Dolan, 2009).

Postgraduate education had been delivered via webinar presentations in Australia and continuing professional development points were applied to these lectures. These online seminars have been presented in various formats which include pre-taped lectures or interactive discussions where remote practitioners can participate in online conferences (Australian Dental Association, 2013). In 2005 in Finland, an educational videoconferencing project transmitted university lectures to various training locations for dental specialist training, which proved to be a cost effective exercise using a simple form of teledentistry (Ignatius et al., 2006).

Teledentistry has been shown to reduce the isolation rural dentists feel by improving patient referral relationships, practice management, education roles and professional organisation communications (Bauer & Brown, 2001; Chen et al., 2003) and it has the potential to be of use across many professional groups which also include General Medical Practitioners, nurses, researchers and students (Kumar, 2015). Another study examined the diagnosis of high-risk lesions in the oral cavity and the positive influence on patient management that communication between medical and dental practitioners facilitated by teledentistry had on referral decisions (Haron et al., 2017).

2.8.7 Patient acceptance of teledentistry

In a study from New York State (USA) in 2016, 251 rural paediatric dental patients were recommended to seek dental treatment after live-video teledentistry consultation. The compliance rate for seeking this treatment ranged from 56% to 100%, suggesting good patient acceptance for teledentistry consultations (McLaren & Kopycka-Kedzierawski, 2016).

Another study attempted to evaluate the acceptance rates of teledentistry. One hundred and thirty-five patients were surveyed consisting of dependent elderly, disabled people, and prisoners, some of whom were cognitively impaired. Those who were not mentally impaired had positive experiences but vulnerable patients with psychotic issues often did not respond well to the teledentistry experience (Petcu et al., 2017).

2.9 Conceptual framework

After reviewing the literature, a conceptual framework was the starting point for this research project and was an important part of the overall research design. Wilson, in 2010, suggested that a wide-ranging set of ideas and ideologies should be taken from related fields of study and combined to give credibility to a study (Wilson, 2010). The beliefs, theories and expectations of this study were scaffolded by the conceptual framework which helped to keep the focus on the research questions

and provided clear connections between the literature and the study objectives (Miles et al., 2013). The conceptual framework developed is illustrated in Figure 2.2 and guided the methodology, data analysis, and research design of this study (Berman & Smyth, 2015).

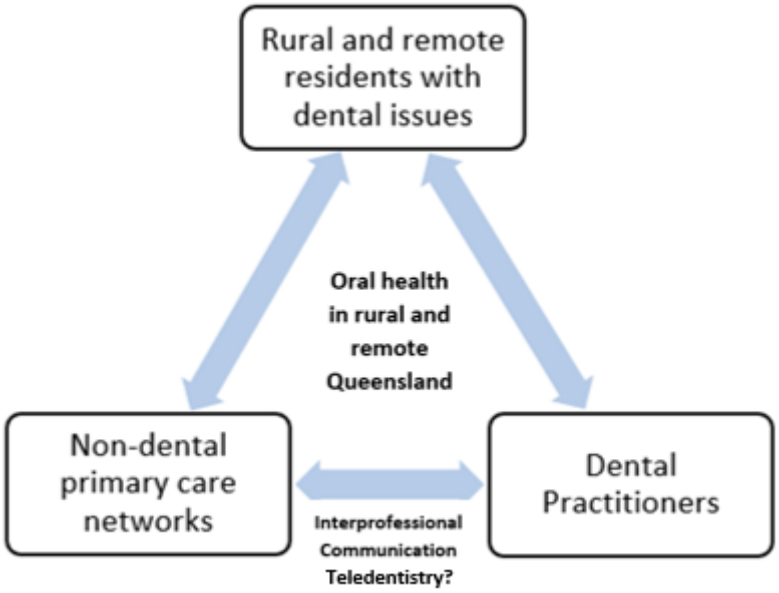

Figure 2.2: Conceptual Framework

The framework of this research project was designed to help study the interprofessional relationships between dental practitioners and non-dental primary care members and the impact that this has on rural and remote residents with dental issues. The aim of this study was to examine the oral health of eight rural and remote Queensland communities from the perspective of non-dental primary care practitioners who lived and worked in these communities and from the dental practitioners who visited these communities. Literature that described rural oral health in Australia and internationally helped shape this conceptual framework. The views of both dental practitioners and non-dental primary care providers about the nature of oral health in the eight identified communities are examined in line with articles examined from the literature. The literature indicated that residents in rural and remote Australia have a greater risk of poor oral health and that barriers exist towards accessing timely oral health care. The literature highlighted barriers for oral health care access such as the costs related to large travel distances to access dental treatments and the maldistribution of dental practitioners, with fewer dentists in rural and remote locations than in metropolitan areas. The connection between non-dental primary care providers, the rural residents (patients) and dental services, are analysed in relation to existing evidence in this literature review. This was identified as a gap in the literature with limited research being evident relating specifically to the impacts that interprofessional relationships between dental practitioners and members of the non-dental primary care networks have on the oral health care access for patients.

Included in this concept of interprofessional communication is the interest of the two different professional groups in utilising dental technology to manage oral health issues. The literature reported the use of teledentistry in other parts of the world, as a possible strategy to improve oral health care access in some rural and remote communities, In Australia this is a new and emerging technology and some of the already recognised applications for teledentistry include: tele-assisted remote dental diagnosis, oral health education, oral health promotion, dentist-to-dental specialist referrals, and dentist-to-dentist collaborations. This study identified a gap in the literature to identify the possible applications for intraoral cameras in medical practice, to encourage remote diagnosis of dental issues that could then be addressed by members of the non-dental primary care networks in the absence of a resident dental practitioner. This study explored the possibility of improving interprofessional collaborations by using these dental technologies.

2.10 Conclusions

This literature review has revealed that rural and remote residents in Australia have poorer oral health status than those living in metropolitan areas. This is often due to factors such as poorer access to oral health care services, workforce shortages, and socioeconomic status. The issues relating particularly to oral health for Indigenous people found that these people required culturally sensitive oral health care services that addressed specific needs of this population group.

Many medical conditions including diabetes, cardiac disease, pulmonary disease, renal disease and pregnancy have been shown to have a link to and oral diseases such as gingivitis and periodontitis. The literature is in agreeance that both medical and oral health are linked, and patients suffer physically, medically, psycho-socially and economically when faced with dental problems that are left untreated. When there is a lack of oral health services, people with an acute oral health problem may present to medical doctors, Hospital Emergency Departments, pharmacies or to an Indigenous Health Centre. Non-dental practitioners are usually able to provide only temporary relief of symptoms and referral rather, than definitive treatment due to lack of oral health training, safety and scope of practice considerations. Consequently, both dental and rural primary care providers may be involved in providing oral health care advice and treatment to rural and remote communities. This study will establish whether this is also the case in the Queensland communities examined.

The conceptual framework was developed and presented in this chapter and guides this research project to provide answers to the four main research questions. The challenges to oral health care access are explored and the strategies to address these challenges are examined with reference to reports from the literature. A gap identified in the literature is to examine the extent to which

collaboration between dental care providers and rural primary care providers will impact on the oral health outcomes for rural people who often have limited access to oral health services and may present to primary care providers with oral health problems for advice and treatment. It is important to investigate how these two disciplines work together to provide oral health care to rural people. However, there is limited research on such collaboration especially in Australia.

Teledentistry is supported in the literature as an effective way to offer better access to oral health care services in rural and remote communities, and this study explores the potential for the use of this technology to also aid in enhancing interprofessional communications between the rural primary health care networks and dental practitioners. The debate surrounding teledentistry and tele-assisted dental diagnosis, centres around the costs associated with equipment purchase, training of image capturing personnel, and the lack of reimbursement for dental practitioners for services billed. Literature supports the use of teledentistry to allow better access to oral health care services in rural and remote communities. The increased use of dental hygienists and dental therapists for teledentistry oral health screenings may result in reduced fees for patient check-ups (McFarland et al., 2017; Moore & Rover, 2013).

The adoption of teledentistry projects into other non-dental health care systems around the world have been shown to be influenced by factors such as the relative advantage of the technology to the community, the compatibility of the technology to other existing projects, people's skill sets in using the technologies, the complexity of the technology, how the concept performs in a trial or pilot study situation and the ability of observers to appreciate the benefits of the technology. This review of the literature has demonstrated that the uses for the technology need to be further explored and that there remain reasons why the technology is not utilised to its full potential and the uptake is slow. Some of the barriers to the uptake of teledentistry in Australia include unfamiliarity with the technology and ignorance of the possible different teledentistry applications. However, some of the already recognised applications for teledentistry include: tele-assisted remote dental diagnosis, oral health education, oral health promotion, dentist-to-dental specialist referrals, and dentist-to-dentist collaborations.

Several gaps in the literature have been identified and this study will provide new information as to the barriers against effective oral health care access and strategies to improve oral health care provision in the eight rural and remote Queensland communities examined. Three different models of oral health care delivery that exist in rural and remote Queensland will be presented which will contribute to the body of knowledge. The interprofessional relationships between dental and non-dental health care providers are examined to determine if this relationship has an impact on patient

outcomes in rural and remote Queensland. The study will ascertain if better interprofessional collaborations would benefit patient outcomes in rural and remote Queensland and if the introduction of dental technology into medical and other allied health care practices would be of interest to either dental or non-dental health care providers to help manage oral health issues .

The next chapter of this thesis introduces the methodological approach taken by the candidate when undertaking this research.

Chapter Three: Methodology

"Without systematic unity, our knowledge cannot become science ; it will be an aggregate, and not a system." Immanuel Kant 1787, philosopher and author of "The Critique of Pure Reason."

3.1 Introduction

Chapter two of this thesis reviewed the current research on the background and existing knowledge of the study topics and established that the four research questions below, have grown directly out of the identified gaps in the literature.

An aim of this study is to map oral health services practice in eight rural and remote Queensland communities across both dental and non-dental primary care providers. This study examines the extent to which oral health problems impact on service provision by primary health care providers, and then examines the extent to which primary care networks could be more effectively utilised to improve the provision of oral health services to rural communities. The final aim is to identify what interventions and strategies are most likely to be effective in improving oral health in those communities.

To address the identified gaps in the literature and to achieve the aims of the study, the four research questions (RQ) have been formulated as follows:

RQ1: What are the barriers and challenges to effective oral health care provision and access in rural and remote communities in Queensland?

RQ2: What is the relationship that exists between dental practitioners and the non-dental primary care networks?

RQ3: What strategies have been suggested to improve oral health in the rural and remote regions examined*?*

RQ4: What is the level of interest in the use of technology by non-dental practitioners and dental practitioners in management of dental problems?

The answers to these research questions will be of potential interest to organisational bodies.

The chapter describes the research design which will include detailed descriptions of the epistemology, paradigms and approach taken, the sampling and recruitment rationales employed, data collection procedures, and the characteristics of the data analysis performed.
The conceptual framework for this study plays a central role as it provides clear links from the literature to the research questions and informs the research design. Furthermore, the framework guided data collection from both non-dental primary care and dental care providers to explore their views and experiences of providing oral health services to rural communities and of their interprofessional collaborations. Berman and Smyth suggest that the framework of a study must be conceptually aligned with the methodology and paradigms driving the study, to provide a suitable backbone for the thesis (Berman & Smyth, 2015). As the study progressed, the conceptual framework provided reference points for understanding the data, structuring the research findings and shaping the discussion.
Finally, this chapter discusses the ethical considerations, limitations of this research project, and the dissemination of the findings.

3.2 Research paradigm and approach

A research paradigm is a model for undertaking a study by organising an assortment of rationally related assumptions or concepts that are then organised in a logical way within the research project (Bogdan & Biklin, 2003). The paradigm involves the methodology of discovery, the epistemology of knowledge acquisition and the ontology of the reality of the situation (Guba, 1990). The choice of paradigm is important because it determines the philosophical research approach that will be taken and determines the underlying beliefs and values of the researcher (Kumar, 1996). The underlying paradigm for this study was to gain an understanding of why people in rural and remote Australia have poorer oral health outcomes than those living in capital cities. A qualitative descriptive case study methodology was chosen for this study, which allowed the study to examine the complex issues in relation to oral health care access within their settings. This research approach has been shown to be a successful method to evaluate health programs, develop interventions and identify what really matters to patients and carers in other health programs (Baker, 2011; Baxter, 2008; Pope et al., 2002). These studies identified that case study research characteristically collects large volumes of data from interviews which are integral to understanding the structures and processes of health care services where there is no easy solution to a health based problem (Baker, 2011).

The research approach to data management and analysis for this qualitative research project drew upon some, but not all, of the approaches of a grounded theory inquiry. In the late 1960s grounded theory was developed by two sociologists Barney Glaser and Anselm Strauss. The rationale for using

a grounded theory approach arose from the basic premise that after the collection of data, it was coded and labelled into concepts and categories and interrelationships between the data begin to emerge. Grounded theory describes how a theory can be generated and formulated from the data as it emerges from the study results (Dawson, 2013). It is a systematic, qualitative process that gradually uncovers a theory that helps to explain the research question in ways that covers many conceptual ideas. In this research project, an established connection to the literature developed as the investigation progressed (Creswell, 2012).

The first step in the research process for this project was the collection of the data through a variety of methods, in this project the tools employed were semi-structured face-to-face individual or group interviews and telephone interviews. From the data collected in this project, key points were noted using themes which were then grouped into areas of similarity. During the data collection process the data was constantly reviewed and re-checked until themes or categories were devised that supported the conceptual framework of this study (Glaser & Strauss, 2009). The underlying theory for this study is that if interprofessional communications were improved then better oral health outcomes would result for rural and remote dental patients. Three distinctly different types of oral health care delivery models emerged from the data that all experienced different methods of interprofessional collaboration.

As the data was collated and analysed, patterns began to emerge and theories began to form about 'cases' or similar situations which some of the eight different communities studied may have experienced. Further data was then sampled to 'theoretically' and purposefully assist in explaining and contributing to the emerging theory about how these communities could be grouped based on an analysis of the type of oral health services provided and the problems these different services faced. As the project progressed the research questions were revealing unsolicited statements on open-ended questions, which is another element that in common with a grounded theory approach (Creswell, 2014). The end result was a set of organised statements that give an overall idea of what the issues were to be studied (Strauss & Corbin, 1990).

The difficulty associated with using a grounded theory approach for this study is any preconceived biases towards the research questions by the researcher (myself). As stated earlier with my personal experiences as a dental practitioner there was an underlying private opinion that the relationship between the rural primary care network and dental practitioners was a good one, especially from the dental practitioner point of view. As the primary researcher in this study, I have taken every precaution to remain impartial as the data unfolded and have found that participants were more

willing to speak about issues and elaborate beyond the interview guide because of existing professional associations.

The use of a fully grounded theory approach as a methodology would have had other drawbacks. It was very important to be able to defend the strict research principles that allowed credibility to this technique. It was essential that an obvious connection was established between the raw data and the categories. The theory that was ultimately developed had to be useful as a conceptual explanation for the issue being studied and it was important to review and modify this theory, as more data was analysed. It was vital to identify a core category, that was at the centre of the research project (communication networks in this case) and that as the coding phased through its stages the model emerged naturally.

Analysis of the data developed over the five year period of the project saw a constant refining and reorganisation to the approach to data assimilation and results as the project unfolded. To keep the data structured, an interview or group summary form was used after each interview, and a running sheet was kept of overall data after each collection. Practical details were also kept such as the duration of the interviews, times and places, content summaries and emerging themes.

It was found that on interviewing some participants, issues were often raised that had not previously been considered and so in the subsequent interviews these issues were elaborated on whilst being mindful of not leading the interview in a specific direction but allowing it to unfold around a loosely followed interview guide.

3.3 Research Design

Research design involves planning and structuring procedures that enable the arrangement of the project to proceed smoothly from determining the problem, to the more detailed implementation of data collection and then analysis (Creswell, 2012) and the publication of the findings (Punch, 2014).

3.3.1 Case study design

A case study design was employed in this study. The case study style is predominantly useful for researching situations where the experiences of the participants are important within the context of their communities (Yin, 2013). One example of a successful descriptive multiple case study design, was a study describing the medical needs of women with Parkinson's disease and their requirements for support by the health care profession to develop models of best health practice (Tolson et al., 2002). This study used a variety of data collection processes including group interviews and semi-structured interviews. Case study-based analysis often puts emphasis more on the process, context and discovery of the issues than the final outcomes, hypotheses and confirmations (Marx et al.,

2014). The case study is a widely accepted research approach in the health studies field (Mannion et al., 2016).

Several researchers (Cavaye, 1996; Jacobsen, 2012; Mannion et al., 2016) suggest that the qualitative case study method may be particularly appropriate to describe a research topic within its real-life context, where the research topic can be studied at one or a number of sites, and where multiple sources of qualitative data may be used. These types of studies give descriptive analysis of a group event, project, policy, decision or a particular situation (Thomas, 2011). If the major purpose of a research project is to better understand the case itself, the type of case study is referred to as intrinsic. If the main purpose of the case study is to better understand a phenomenon of interest, the case study type is referred to as instrumental (Stake, 2005). As the aim of this research project was to understand the phenomenon of relationships between non-dental and dental care providers in providing oral health services, its purpose was instrumental.

A distinction is also made between a single and a multiple case-study design. It has been suggested that the evidence from multiple case studies is considered more compelling and robust than the evidence from single case studies (Yin, 2013). One criticism of the single case study design has been that although this type of study encourages a substantive and in-depth understanding of the studied phenomenon, it might encourage unsubstantiated generalisations about a situation. Sometimes subjects of case studies may be unusual in some way and may not be representative of the generalised community perception (Long & Hollin, 1995).

A multiple case study design allows for a wider diversification of views from different perspectives, which may still allow for generalisations, but introduces a more robust data set to the study (Stake, 2005). An example of a robust multiple case study design was of a study in the USA that examined 22 communities about the success of a community-based program helping victims of sexual abuse. A successful counselling model was developed due to the wide range of experiences that could be analysed using many participants and communities (Campbell & Ahrens, 1998). Following this example, three descriptive case studies were developed in this study, using groups of communities that experienced different mechanisms of oral health care service delivery and different dental and non-dental health care providers. This enabled the exploration of differences, and similarities, between the three case studies and to make an observation as to which case study was experiencing the most effective oral health care service. Case studies involving groups are often more conclusive than those with distinct individuals, therefore it was important that the sample size for each case study was sufficiently large enough to provide meaningful results about the local oral health situation. The multiple case study design allowed for the explanation of complicated oral health

delivery situations across rural and remote Queensland, where the services provision was not standardised, and each community had their own management strategies to address the oral health care needs of residents (Yin, 2013).

Case studies may be traditionally either historical, occur in real time or be a combination of both. In this project, they were conducted in real time and essentially provided a snapshot of the situation occurring at the time of the interview. The participants often reminisced about how the situation had changed with time, so an element of historical observation was introduced (Stake, 2005). A selection of interview types ranging from individual interviews to group interviews were undertaken. The challenge of reliability was addressed by cross analysis and collaboration with the research team members of the larger Australian project to allow biases to be eliminated (Bell, 2014).

A significant decision in case study research is the selection of the cases. Cases may be chosen to reproduce past results, expand on a new theory, or to provide examples of alternative perspectives (Eisenhardt & Graebner, 2007). In this study, the cases were selected to show three very different models of oral health care delivery in rural and remote Queensland. Case studies allowed an in-depth rather than a superficial study of the oral health issues in rural and remote Queensland. This project was divided into three case studies which were bounded by: the local policy context, the geographical location, population characteristics, and the range and mix of oral health services.

3.3.1.1 *Setting for this study*

Queensland has a vast and diversified population distribution with 70.2% of the residents living in the South East corner of the State in regional and metropolitan centres. The other 29.8% are spread over a huge distance (1.853 million km²) of rural and remote and often arid areas (Queensland Government Statisticians Office, 2015). The provision of quality dental and medical care can be a challenging task due to the distances of many thousands of kilometres that may separate communities from regional centres. Queensland's hospital and health services are managed under three main areas and 16 districts which support the management and distribution of primary health care providers to hospitals and medical care facilities around the vast state (Queensland Department of Health, 2011).

Rural and remote Queensland regions have a shortage of available oral health care practitioners (Olive et al., 2012; Perera et al., 2010). The non-dental primary care network in Queensland's rural and remote communities often have to deal with patients with dental issues in the absence of a resident dental practitioner. From 2007-2008, dental conditions were the third most common reason for potentially preventable hospitalisations in Queensland (Houweling, 2008).

3.3.2 Sampling and recruitment

This section discusses inclusion criteria, sampling strategies and the recruitment of study sites and participants.

3.3.2.1 *Rural and remote definitions*

At the time that this study was conducted the Australian Institute of Health and Welfare (AIHW) used a geographical classification system, the Australian Standard Geographical Classification Remoteness Areas (ASGC-RAs), to describe a location in terms of remoteness. The ASGC-RA defines remoteness as a measure of the physical distance of a location from the nearest Urban Centre (access to goods and services) based on population size. The ASGC-RA is a statistical geographic structure which allows quantitative comparisons between 'city' and 'country' Australia. The ASGC recognises five categories of remoteness: *Major Cities* (RA1), *Inner Regional* (RA2), *Outer Regional* (RA3), *Remote* (RA4) and *Very Remote* (RA5).

The term *'rural and remote'* was used to encompass all areas outside Australia's major cities and includes (RA2, RA3, RA4 and RA5) (Australian Bureau of Statistics, 2013a).

Table 3.1 illustrates the proportion of the Australian land mass in each ASGS RA and the proportion of the population residing in each ASGS RA.

Table 3.1. Area of Australian land mass, and population, by ASGS Classification

ASGS Classification	Examples of locality	Area Squared km	Area (%)	Population (N)	Population (%)
Major cities (RA1)	Most capital cities, major urban areas such as Newcastle, Geelong, the Gold Coast	18,890	0.25	16,490,471	70. 2
Inner regional (RA2)	Cities and towns such as Hobart, Launceston, Mackay, Tamworth, Yass, Ballarat, Murray Bridge, Bathurst,	246,329	3.2	4,322,289	18. 4
Outer regional (RA3)	Cities and towns such as Albany, Whyalla, Moree, Darwin, Cairns, Biloela, Devonport	783,988	10.2	2,137,654	9. 1
Remote (RA4)	Cities and towns such as Alice Springs, Roma, Esperance	922,333	12.0	328,870	1. 4
Very remote (RA5)	Towns such as Tennant Creek, Longreach, Coober Pedy	5,716,051	74.35	211,416	0. 9
Total		**7,687,591**	**100**	**23,490,700**	**100**

Source: Data extrapolated from Australian Bureau of Statistics (Australian Bureau of Statistics, 2013a)

The first inclusion criteria for Queensland communities in this study was that they had to be classified as either ASGC-RA2 (Inner Regional), ASGR-RA3 (Outer Regional), ASGC-RA4 (Remote) or ASGR-RA5 (Very Remote).

3.3.2.2 *Inclusion criteria for study sites*

The inclusion criteria for suitable study sites were towns that met the following criteria:

- They were classified as ASGC-RA 2 (Inner Regional), ASGR-RA3 (Outer Regional), ASGC-RA4 (Remote) or ASGR-RA5 (Very Remote) by the Australian Standard Geographical Classification Remoteness Areas (ASGC RAs), i.e. non-metropolitan areas.
- Oral health care was a significant problem.
- There was no resident dentist/dental surgery, but at least one general medical (GP) practice, a health care facility and a pharmacy in the community.

3.3.2.3 *Recruitment of study sites*

The recruitment of the study sites was conducted using purposive sampling in a two-stage sampling technique. An invitation letter that introduced the research topic and an information sheet that explained its relevance to the oral health care provision for rural Queenslanders, was sent to the Chief Dental Officer for Queensland, by this candidate(See Appendix E and F). The purpose, benefits and procedure of the study and the inclusion criteria for community suitability and selection were outlined in this correspondence. Follow up phone calls were made, by this candidate, one week and two weeks later with the result being support and approval for the project from the Chief Dental Officer in Queensland and a supplied list of suitable communities meeting the inclusion criteria. More than eight communities were identified by the CDO Queensland but on closer examination, by this candidate, some of these communities did not fully meet the study criteria in relation to medical facilities or pharmacy availability. Figure 3.1 shows an approximation of the locations for the eight Queensland towns meeting all of the study criteria, that were consequently selected. The sites were designated an alpha code, and their location only approximated on the maps to indicate their relative isolation from major regional centres.

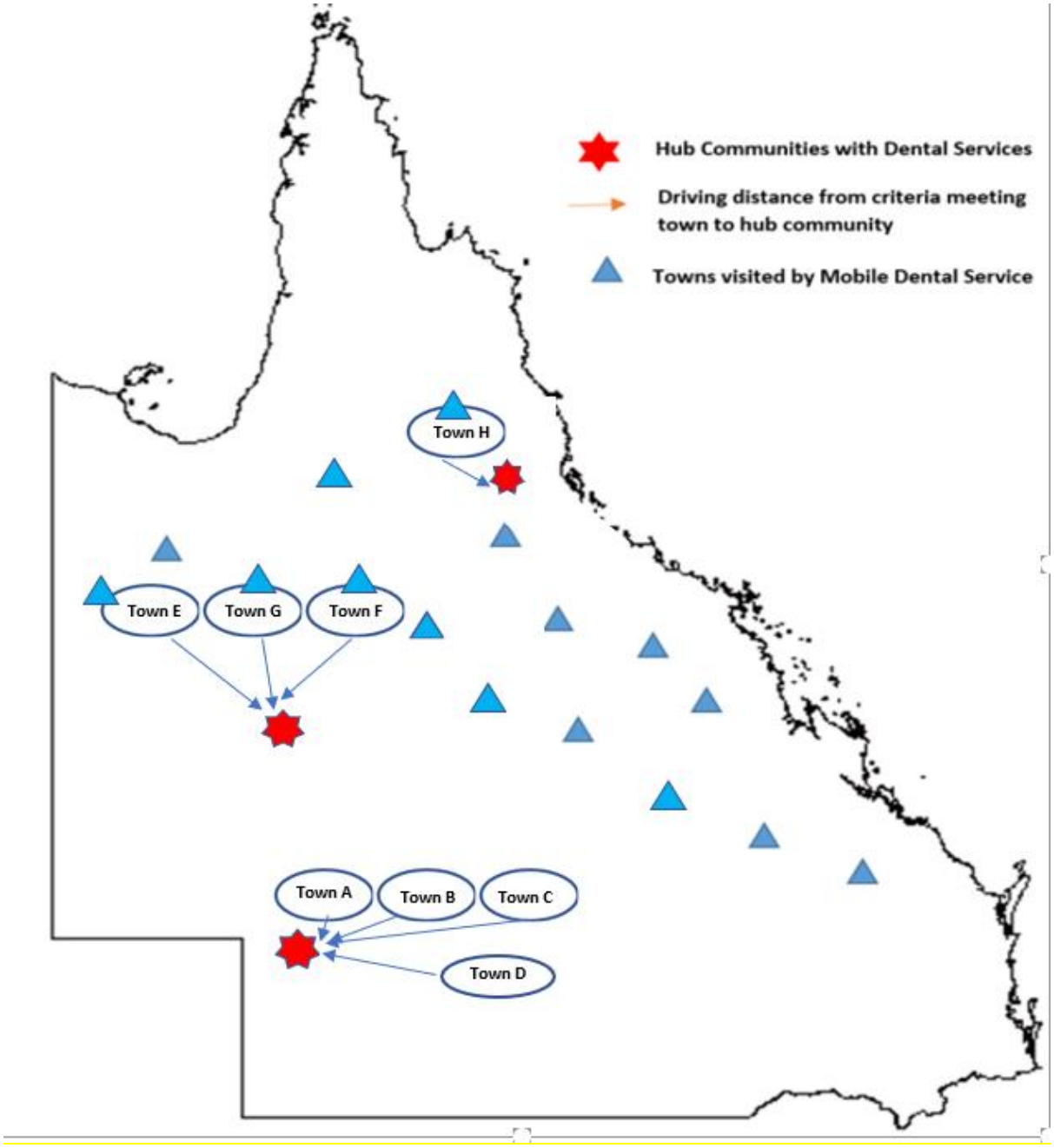

Figure 3.1: The eight de-identified Queensland communities studied Towns A-H

The participants from the first four communities, in the first Queensland health district examined, reported accessing public oral health care services for their patients by referring them to a Central Referral Centre. The participants from the next three communities, from a different Queensland region, described accessing their public oral health services via a directly contactable public dentist attached to a hospital in a community in the middle of the region. As this information was discovered it became clear that these two different oral health care delivery models might contribute to separate case studies. A third model of oral health care was incidentally discovered when participants from the second group of communities also described a sporadic oral health

service from a philanthropic mobile dental service that serviced their communities and others in rural and remote Queensland. Participants were then actively recruited from an eighth community that met the study criteria because they also received oral health services from this mobile dental service delivery model. This mobile dental service evolved into the third case study.

Each of the three case studies utilised a different model of oral health care delivery.

Case Study 1 consisted of four communities where referrals for public dental care were triaged through a Central Referral Call Centre. Members of the non-dental primary care network either left a message on an answering machine or with an operator who had limited dental triaging knowledge. A private dental practitioner in an adjacent community treated patients who could travel large distances to access that private dental care. The communities also received very sporadic school dental services and a mobile Indigenous health care clinic that visited very infrequently.

Case Study 2 consisted of three communities receiving oral health care services from a public dental service where referrals were triaged directly with the government dental clinic personnel. Patients who were ineligible for public dental care accessed dental care from a fly-in/fly-out private dental practitioner or from a regionally located private dental practitioner that patients travelled large distances to access.

Case Study 3 considered the oral health delivery service provided by an NGO Mobile Dental Service established in 2013 and jointly funded by a private mining company, a non-government organisation and with some funding from the Commonwealth Government. This philanthropic mobile dental service visited several rural and remote Queensland communities once a year. The communities that received this service varied from year to year depending on their perceived need and their proximity to other oral health care services. Four communities were included in this third case study which included the three communities from the second case study. The data specifically relating to experiences of the NGO MDS in the second case study was separated for re-examination. A fourth unrelated community was added to this case study to introduce new participant views. The community characteristics for each of the three separate case studies are summarised in Table 3.2.

Table 3.2 Characteristics of the three case studies with different oral health delivery models

CASE STUDY ONE (2013-2014)				
Town	**Population**	**Nearest dental surgery**	**Oral Health Delivery Model** Central Referral Call Centre for Public Dental Patients	**ASGC Remoteness areas**
Town A	1641	199 km 2 hr drive	**Other Dental Services**	RA5-Very remote

			• Private dentist visits once a month from a distant hub community • School dental van sporadic visits	
Town B	911	87 km 1 hr drive	• Private dentist once a month	RA4-Remote
Town C	976	210 km 3 hr drive	• Private and public dentist visits once every 3 months • Mobile Indigenous Dental Service once a year • School dental van sporadic visits	RA5-Very Remote
Town D	3292	195 km 2 hr drive	• Public dentist visits once a month • Mobile Indigenous Dental Service once a year	RA4-Remote
CASE STUDY TWO (2014-2016)				
Town	**Population**	**Nearest dental surgery**	**Oral Health Delivery Model** Referral process involved direct contact with dental personnel in the public dental clinic	**ASGC Remoteness areas**
Town E	954	179.3 km 2 hr drive	**Other Dental Services** • Public dentist once a year • NGO Mobile Dental Service, once a year	RA5-Very remote
Town F	1558	213.6 km 2.25 hr drive	• Private dentist once a month for 3 days from Brisbane • School dental sporadically • NGO Mobile Dental Service, once a year	RA4-Remote
Town G	349	247.95 km 2.50 hr drive	• Public dentist once every 3 months • School dental sporadically • NGO Mobile Dental Service, once a year	RA5-Very Remote
CASE STUDY THREE (2014-2016)				
Town	**Population**	**Nearest dental surgery**	**Oral Health Delivery Model** NGO Mobile Dental Service	**ASGC Remoteness areas**
Town E	954	179.3 km 2hr drive	**Other Dental Services** • Public dentist once a year • NGO Mobile Dental Service, once a year	RA5-Very remote
Town F	1558	213.6 km	• Private dentist once a month for 3 days from Brisbane	RA4-Remote

		2.25 hr drive	• School dental sporadically • NGO Mobile Dental Service, once a year	
Town G	349	247.95 km 2.50 hr drive	• Public dentist once every 3 months • School dental sporadically • NGO Mobile Dental Service, once a year	RA5-Very Remote
Town H	1501	87 km 1hr drive	• Public dentist twice yearly • School dental sporadically • NGO Mobile Dental Service, once a year	RA4- Remote

3.3.2.4 *Recruitment of participants*

Non-dental primary health care providers located in the selected communities were invited to participate in this study. Those members of the primary health care network included private and government employed General Medical Practitioners, Nurse Practitioners, private and government employed pharmacists, mental health nurses, speech pathologists, physiotherapists, child care nurses, community and women's nurses and midwives, Indigenous health care providers, practice managers and medical receptionists. Dentists, dental therapists and dental nurses who visited these communities as private locum or government based oral health care providers, or those based in neighbouring communities, were also invited to participate.

To have gained the required qualifications to work in these professions it was anticipated that all participants would be over 18 years of age, be of varying degrees of experience and of different ages, nationalities and genders. Participants were recruited using both purposive and snowball sampling strategies (Rice & Ezzy, 1999a). Primary care providers were recruited through the managers of the general medical practices, pharmacies, hospital and other health care services of these communities. The managers were asked to identify staff who had been involved in providing advice to a patient with an oral health problem. These practice managers, Hospital Directors of Nursing (DON) and receptionist staff of these services were identified as the "gate keepers" to the non-dental health care provider participants.

Once contact had been made with the gate keepers, they were asked to forward to the identified potential participants a study information package that included: an information letter to each professional group, an invitation letter to each professional group, a copy of the interview guide and a copy of the consent form outlining the procedures for the protection of individuals participating in

the study (see Appendices E, F,G). These information packs were distributed weeks ahead of the interviews and the participants were given a choice to join in either an individual interview or a group interview.

Indigenous health care workers were not included as part of the original sampling group, but three of these health care workers were incidentally interviewed in the second case study. Their input greatly enriched the findings for this research project and further study specific to the experiences of this group within the community would be an area for future research.

3.3.3 Data collection procedures

At the beginning of the interviews the purpose of the study was again clearly explained to each participant and group and all due care was taken to ensure that the participants fully understood the voluntary nature of participation. It was verified that the consent forms were signed before interviews took place. Permission was asked to record the interviews for transcription and it was stated that the taping could be paused at any time if the participants felt uncomfortable. Confidentiality arrangements for the data collected and the deidentification of participants was explained and is outlined in detail in Section 3.4 of this chapter.

3.3.3.1 *The interview guide*

The results of a literature review and the aims of the study guided the development of the interview questions presented in Table 3.3. The questions were then piloted with a rural dentist and a pharmacist, in the parent project. The result was that some questions were reworded, for this Queensland specific project, to allow dental personnel to be questioned and to ask questions about interest in teledentistry applications.

The interview guide contained questions relating to issues such as the profile of the practice, participants' professional backgrounds, information on the number of people who requested oral health advice or treatment, which treatments or advice were provided and their level of confidence with these, the communications that occurred between the dental and non-dental health providers.

The interview guide (see Table 3.3) was apportioned into six parts to address the four research questions. The full interview guide is contained in Appendix G.

Table 3.3: Interview guide

Interview Guide

Interview Part	Research Questions	Research Question Frameworks
1	Background participant information. RQ 1	• Profile of medical practice. • Profile of oral health care service delivery. • Oral health care product lists in pharmacies.
2	Barriers/ Strategies for oral health care access. RQ 1, RQ 3.	• Barriers to oral health care access. • Strategies to improve oral health care provision.
3	Community oral health status. RQ 1.	• Number and types of oral health presentations. • Treatments/advice given by the non-dental primary care providers. • Confidence of non-dental primary care providers to give oral health care. • Types of oral health treatments provided by oral health care practitioners.
4	Interprofessional Communication. RQ 2.	• Dental referral procedures. • Interprofessional collaborations experiences.
5	Teledentistry. RQ 4.	• Interest in teledentistry/intraoral cameras. • Interest in including dental practitioners into treatment planning teleconferencing.
6	Oral Health Awareness. RQ 1, RQ 2, RQ 3.	• Oral health promotional activities. • Upskilling non-dental primary care providers.

3.3.3.2 *Semi-structured interviews*

Three types of interviews are used in qualitative research and each type was explored to decide which would be more appropriate for the approach. Specific methodological viewpoints and questions were associated with each type of interview and other influencing factors in choosing interview types included the interviewer's style, participant's characteristics and the social context for the study (Hansen, 2006).

One type of interview considered was the unstructured interview, which is often very in-depth but with very little evident structure. The participants are free to discuss any issues important to themselves and the interviewer limits their own directional influence. This type of interview would be a difficult structure to analyse and the interviewer would need tact to bring the participant back to topic when necessary, whilst also allowing the participant to follow their own thought flow (Dawson, 2013). After consideration, it was decided that a more structured approach suited this

study due to the sheer volume of data to be collected and analysed. Some control was needed to direct the flow of information gathering.

Structured interviews ask specific questions that allow statistical data to be collected. This type of interview technique was deemed by the candidate to be too rigid in form as this "relationship study" required a slightly more flexible format that allowed some free discussion by participants whilst still maintaining some control.

Consequently, semi-structured interviews were utilised as these can be qualitative or quantitative dependent on the number of people who are interviewed and on the number of similar answers given to the same questions (Bell, 2014). An interview schedule was developed so that the same questions were asked of each participant but in a way that individual digressions could occur. This allowed new information to be uncovered which was often used in new questions for the subsequent interviews and thus a developing picture was built-up. The individual and group interviews lasted from 37 minutes to 90 minutes and were conducted at the participants' workplaces by the candidate and an accompanying team member between October 2013 and May 2016. Further telephone interviews were conducted by the candidate alone between June 2016 and December 2016. After being trained by the primary supervisor during the first series of interviews, the candidate then took a lead in the interview process for all of the participants from rural and remote Queensland.

Discussion groups or group interviews are small groups of typically between three to eight participants, who come together for an in-depth discussion on a specific issue (Dawson, 2013). Group interviews are commonly used in qualitative research and in this study the interviews were often conducted in this way. This method was very useful when identifying the experiences, feelings and beliefs held in common by the groups, but statistics were often discussed and thus a quantitative element was also introduced.

For this project a set of interview questions were presented to the groups and when permission was given the discussions were recorded and transcribed at a later date. The candidate acted as a moderator or facilitator by controlling the group and introducing the topics, asking the questions, redirecting digressions and discouraging break-away conversations. The disadvantage of these group interviews was that some participants were nervous in expressing their personal opinions in a group and often a leader was evident who dominated other participant's opinions.

The advantage however of the group interviews was that sometimes in a like-minded friendly group the participants relaxed and expressed their opinions more feely than in a face-to-face or one-on-one interview. When enough flexibility was allowed in the interviews, new questions could be asked in response to issues brought up by the participant. Table 3.4 details the types of interviews and the

numbers of participants per interview. A total of 67 participants were interviewed in a combination of face-to-face single or group interviews in the field, or using phone interviews for those participants who were constantly travelling to different rural Queensland communities.

Table 3.4: Types of interviews and the number of participants in each interview type

Interview Types (37:46 minutes to 1:36 hours duration)			
	Case Study One 2013-2014	**Case Study Two 2014-2016**	**Case Study Three 2016**
Number of individual interviews	17 non-dental participants *Interviewer: Candidate and two observing supervisors*	11 non-dental participants 1 dental participant *Interviewer- Candidate and one observing supervisor*	11 non-dental participants from Case Study Two 1 dental participant from Case Study Two *Interviewer- Candidate and one observing supervisor*
Number of Group Interviews (GI)	3 GI 1: 10 non-dental participants GI 2: 4 non-dental participants GI 3: 3 non-dental participants *Interviewer: Candidate and two observing supervisors*	2 GI 1: 4 non-dental participants GI 2: 3 non-dental participants *Interviewer: Candidate and one observing supervisor*	2 (from Case Study Two) GI 1: 4 non-dental participants GI 2: 3 non-dental participants *Interviewer: Candidate and one observing supervisor*
Number of telephone interviews	4 dental participants *Interviewer: Candidate*	2 dental participants *Interviewer: Candidate*	4 non-dental participants 5 dental participants 3 dental participants from Case study 2 *Interviewer: Candidate*

3.3.4 Data analysis

The main aim of a data analysis is to derive plausible conclusions from the data, while preserving a clear line of evidence (Runeson & Höst, 2008). The process of uncovering themes within the data and analysis of these themes will be discussed as well as the reliability and validation strategies employed. Interview data were analysed using the six phases of thematic analysis (Braun & Clarke, 2006b).

Phase 1: The candidate conducted and then transcribed all the interviews verbatim from recordings. The next process of reading and rereading the data, whilst also taking notes and searching for meaning and patterns in the data, allowed the candidate to develop an understanding of emerging issues.

Phase 2: The systematic examination of the data and initial coding and collation of the comments (Miles et al., 2013). Coding is the procedure of naming or classifying objects or characteristics or categories. The sheer volume of the final data set was very extensive and a qualitative data analysis software package QSR - NVivo v10.0 was used to enhance the research process by speeding up the data collation (QSR International Pty Ltd, 2014).

The candidate dissected the data into topic related comments that were identified and entered as "nodes/codes" into the software program to give a more structured set of results to allow a more meaningful evidence-based description (Joffe & Yardley, 2004). The careful use of as many nodes as possible enabled data entry into two or more nodes so that pieces of data that may have seemed irrelevant at the time were not overlooked as different themes evolved. The use of the computer assisted software package NVivo10, proved to be a valuable aid in reducing the complexity of organising the total amount of the data but still required analytical skills to manipulate the data properly and to identify comments relating to similar issues (Bazeley & Jackson, 2013). The skilful use of software to aid analysis has been shown to enhance the validity of a qualitative research project (Kikooma, 2010) and can condense investigation timeframes and provide more detailed and precise coding and analysis (Jones, 2007). See Appendix C for a detailed description of the thematic analysis techniques utilised by the Nvivo 10 computer program.

Phase 3: Data immersion and examination and recognition of the trends and themes being presented (Bringer et al., 2006). The process of sorting the nodes into identified thematic headings began after reading the data carefully time and again to make sure that no word was left un-coded (Fereday & Muir-Cochrane, 2008). Themes were selected by considering the importance of the topic as an illustrative factor rather than the frequency of its occurrence (Blatt, 2006). The identification of the new themes from the raw data for this project was simplified using some standard interview

questions but other new emerging themes were also recognised which were not the result of the standard questions, but from the thoughts and emotions of individual participants.

Phase 4: Further review and refinement of the themes, to identify how they related to each other. In organising the codes into themes it was always important to relate back to the structural framework of the study to maintain focus (Miles et al., 2013). Some themes merged with each other and some needed to be reworked to be broken into two or more separate themes (Braun & Clarke, 2006b). In this research project the data was analysed using a combination of ideas gathered from the literature review and from the key patterns and trends in the data. Recurring themes emerged from the interview data (Dawson, 2013) and as a further stage of the analysis a process of comparative and content analysis was undertaken. Comparative analysis compares themes for similarities and differences, and content analysis is when new themes emerge. The content analysis resulted in the necessity of revisiting the earlier interviews to examine them for any previously missed themes (Dawson, 2013). A thematic map was generated from the Nvivo 10 software package which helped the candidate to develop an understanding of the forming thematic analysis (See Appendix C).
A quantitative element of the data analysis was obtained by counting the numbers of entries under the same themes from the different participants. This allowed for some quantification of the qualitative data.

Phase 5: Refining the details and definitions of the themes. Some of the themes at this stage needed to be refined, as they were too diverse and consequently some subthemes were added under the parent theme to give detail. For instance, under the theme of strategies to improve oral health care provision, there were specific suggestions that required their own subthemes to fully understand the mechanisms for each suggested strategy. Each theme and subtheme were clearly named and defined in such a way as to succinctly address the issue it was relating to.

Phase 6: Detail the thematic analysis and produce the final report by selecting exemplars that were good examples of comments relating to the defined themes. These extracts required an analytical narrative to relate the exemplars back to the research question that they addressed and then to further relate back to the literature and research questions.

3.3.4.1 *Reliability and validation strategies*

A strength of qualitative research is in the reliability and validation of the research (Creswell, 2012). The data collection and coding procedures described in the previous section ensured the reliability of the results of this study. The double checking of the coding procedures in the first case study by an experienced team member reinforced this. All interviews were recorded and transcribed exactly as the participants spoke, using normal colloquial speech and linguistic errors and thus it was

understood that the interviewees engaged in clarifications and meaning-sharing-processes with the participants. Analysis and coding of the accumulated data was guided by respected texts on the subject (Bazeley & Jackson, 2013; Creswell, 2012). These texts recommend that all qualitative research should include at least two validation procedures to give accountability and reliability to the data.

The following sections describe the validation strategies employed which included triangulation, saturation, peer review, and researcher reflexivity.

3.3.4.1.1 *Triangulation*

Two of the most important aspects to any study are credibility and trustworthiness (Flick et al., 2004). Research triangulation of the data is done by having several data collection strategies (Brewer & Hunter, 1989). Data for this research project was consequently collected from three different sources: dental practitioner interviews, non-dental health care provider interviews, and existing data from the literature. The experiences of primary care providers were triangulated with the experiences of dental care providers and then related to the existing literature on interprofessional communications. Site triangulation, where at least three different study sites are selected, also increases study reliability and validity where similar results emerge at different community locations (Shenton, 2004)

The triangulated interview data from different sources and sites helped with the understanding of the patterns of interprofessional collaboration between the rural primary care network and dental practitioners in remote Queensland communities and allowed the data set to be gradually developed, elaborated and confirmed.

3.3.4.1.2 *Saturation*

Data saturation occurs when no new findings are being discovered as interviews progress (Creswell, 2012; Morse, 1995). Recruitment of participants for this study from different geographical Queensland regions across both dental and non-dental health care providers ensured that a range of perspectives was included. The coded data was analysed by both professional type and geographical region and thus contributed to developing an understanding of the inter-relationships across the themes and sub themes. Recruitment continued throughout eight communities in rural and remote Queensland that met the project inclusion criteria until data saturation was reached as defined by there being no new thematic responses, no new emergent findings, and the concurrent data analysis showed data saturation (Morse, 1995).

3.3.4.1.3 *Peer review*

Peer review was a continual process for this project. Debriefing was achieved by regular input via phone and face-to-face meetings with the three PhD supervisors who demonstrated different perspectives to the research, gave regular feedback and critically assessed and questioned the assumptions and emerging interpretations. The results from this original research contributed to the publication of four journal articles which were subject to the rigorous peer review processes for publication, thus reinforcing the validity and reliability of the research findings and analysis reported in this thesis. A further validation of this data was undertaken for the first case study when the candidate and another more experienced researcher (one of the assigned PhD supervisors), independently entered and analysed the data set. Regular supervisory meetings were held and any discrepancies between the two sets of coding were compared and discussed and any differences were reconciled until consensus was reached. Consequently, the results for the first case study were tested, verified and validated. The candidate was then deemed, by all three supervisors, to be ready to analyse the next two case studies independently.

3.3.4.1.4 *Researcher bias disclosure*

Clarifying the bias that a researcher brings to a study is an integral aspect of research (Miles et al., 2013). As the candidate is a dental practitioner, some participants may have responded with accepted responses rather than more honest perspectives which may have been because they were conscious of "scope of practice issues". The recruitment for interviews was very successful with almost 100% response rate to participate in interviews and perhaps this was because a dental practitioner was demonstrating a sense of commitment to uncovering the oral health care problems in their communities?

3.4 Ethical approval and issues

All research methods recognise the critical importance of the ethical part of research and consequently it is vital to build sound ethical principles into the design of any research project at the beginning of the research process (Jacobsen, 2012). This section describes the principles of ethical research considerations and design outlines in alignment with the National Health and Medical Research Council guidelines that were adhered to in this study. It describes the processes by which the original approval was obtained from the Tasmanian Health and Medical Human Research Ethics Committee the subsequent amendment to this application to expand the study design to include dental personnel interviews (see Appendix D).

3.4.1 Ethical considerations

When conducting any research, the researcher has an ethical responsibility to minimise the risks that that research might present to participants (Jacobsen, 2012). Around the world, the ethical guidelines for research have been guided by specificities associated with different contexts and countries. The Australian Code for the Responsible Conduct of Research is the guide by which Australian organisations and investigators must conduct responsible research practices. Any study involving human participants must display morality and integrity, and be respectful of rudimentary human rights, and to obey the guidelines set out by the National Statement on Ethical Conduct in Human Research (National Health and Medical Research Council, 2007).

Three main principles apply to ethical research guidelines: beneficence, autonomy, and justice. Beneficence basically means that no harm, physical or psychological, should come to the participants from the research process. Autonomy means that the participants must be given free choice to volunteer or not in the research project and must be fully informed as to the procedures involved and the plans for the final collected data. It essentially involves basic respect for the rights of the participants from the researcher. Justice ensures the participants that benefits and problems identified by the research will be fairly represented by the researcher (Jacobsen, 2012).

However, good ethical considerations not only refer to researcher behaviours when engaging and interviewing participants, but also to the ethical paradigms of the project in relation to the design and procedures used in the research.

This study was deemed to be one of minimal risk to participants and the probability of harm or discomfort to any participant was anticipated to be no greater than any ordinarily encountered in daily life, which complied with the requirement of beneficence. Information packages were distributed, and consent forms were signed by all participants before interviews, to allow participant autonomy. All endeavours were taken to maintain objectivity, integrity, honesty, confidentiality and respect for all participants involved. Finally, the intellectual property of the participants was respected, and their views were reported in their unadulterated states, which allows for distributive justice to be observed.

3.4.2 Ethics Research Approvals

This research project required ethical approval to be gained from three separate bodies. The main, over riding body for the entire research project was the Tasmanian Health and Medical Human Research Ethics Committee. To conduct this research in Queensland it was also necessary to gain approval from the Executive Director of Medical Services (Queensland) for the second case study

and from the Non-Government Organisation Research Committee (Queensland) for the third case study.

3.4.2.1 *Health and Medical Human Research Approval*

In the case of this project the original approval for the larger research project with the title, "Relationship of dental practitioners to rural primary care networks" was achieved with the Tasmanian Health and Medical Human Research Ethics Committee (reference number: H0013217). An amendment to this original document was submitted to allow the interviewing of dental personnel to provide a balanced research platform. This amendment was approved on 19/2/2014. See attached Appendix D.

3.4.2.2 *Executive Director of Medical Services Approval*

The second case study was held in three communities where it was necessary to obtain the approval to conduct interviews from the regional Executive Director of Medical Services. A phone interview time was set up between the candidate and the Executive Director and a subsequent face-to-face interview time was established with the candidate and the team leader and PhD supervisor, Associate Professor Anthony Barnett. In agreement with the ethical standards from the Australian Code of Responsible Conduct in Research, confidential information was promised to only be used in ways agreed upon by those who provided it. Approval was obtained from the Regional Executive Director of Medical Services to carry out the interviews. This medical director attended two group interviews and the dental practitioner interview, and was then satisfied to allow the remaining interviews to be conducted in his absence.

3.4.2.3 *Non-Government Organisation Approval*

The third case study required approval via the NGO's Research Committee to conduct phone interviews with dental personnel from the NGO Mobile Dental Service. Approval to interview these dental participants was obtained from the Chair of the NGO Research Committee on 31-03-2015. A confidentiality deed was signed by the candidate to agree to show any relevant journal articles to the committee for pre-approval before publication. A proposed journal article with reference to the NGO Mobile Dental Service was submitted to the committee for perusal as requested and was approved before being submitted to peer review for publication.

3.4.3 Ethical Procedural Design

The ethical procedural design for this study allowed for the minimisation of potential risks and discomfort to all participants. The individual beliefs, cultural sensitivities, privacy, confidentiality, rights and perceptions, of the participants were given great consideration to enhance their health and wellbeing and to offer beneficence. It was explained that participation in the interviews was

voluntary and that they were able to withdraw their participation without any explanation, at any time.

A conflict of interest was identified early in this research project by one of the candidate's supervisors. Associate Professor Len Crocombe described his involvement in several oral health promotional programs such as the Dental Relocation and Infrastructure Scheme (DRISS) and the Voluntary Graduate Dental Year Program (VGDYP). Consequently, as a risk mitigation strategy he did not participate in the interviews or the analysis of the interview data.

3.4.3.1 *Participant protection ethics*

The participants were informed before the interviews of any potential risk or benefits from their participation in this research project. The interviews were conducted in a relaxing atmosphere in areas designated by the participants. Participants were encouraged to answer all the questions asked but were also welcomed to skip any question. The participants were asked if the interviews could be recorded to allow transcription by the candidate at a later time and were told they could request the tape be stopped at any time, which allowed the participant control and autonomy. The audio recorded interviews were transcribed verbatim into Microsoft Word and then cross checked by two members of the team against audio recordings for errors. Each participant was assigned a numerical code in relation to profession type to maintain anonymity.

3.4.3.2 *Data storage ethics*

The recorded audio files of the participants were accessible only to the candidate and her supervisors (Chief Parlimentary Council., 2014). Participants could access copies of their audio-recorded files and transcripts within five months of the interviews and before publishing and could withdraw any information. Whilst in the field, the data was secured and protected with a password. Once the study was completed, electronic data was stored in a restricted “CRH research data archive” folder located on the Faculty of Health Sciences “S” drive under “Research” on password protected computers at the Centre for Rural Health, University of Tasmania. After five years, it will be destroyed.

Under policies for ethical code of conduct, to allow defence and justification of challenged research outcomes at a later date, sufficient data must be retained (National Health and Medical Research Council, 2007). This folder has access restricted only to the designated Archives Officer for the Department and the Deputy Director who established and maintains a registry of projects for which data are held and destroyed after this five year period.

3.4.3.3 *Sharing research discoveries*

An important ethical responsibility of the research process is the sharing and dissemination of research discoveries to a wider audience which may include dental or non-dental health care practitioners, other researchers or political bodies. A full copy of the study results from the larger Australian-wide study, of which this Queensland study is a part, is available electronically through the Tasmanian University Centre of Rural Health website.

Reports from the study may be submitted to government or professional agencies and consequently the candidate presented to the Rural Health Workforce Research Exchange to inform policy on dental workforce issues in rural Australia in November 2015. Other conference presentations by the candidate's supervisors have further disseminated the research findings whilst always adhering to strict ethical standards. Individual participants or communities have not been identified in publications or conference presentations.

The candidate's authorship roles in these four published journal articles and the final report submission to the Australian Primary Health Care Research Institute, are based on substantial contributions with a combination of data gathering and analysis, drafting certain parts of the work and critically reviewing the articles to contribute to their interpretation.

3.5 Summary

The conceptual framework which underlies the design of this study was presented in this chapter. The framework hypothesises the relationship between the non-dental primary health network and dental practitioners and the effect that this has on oral health care provision in rural and remote Queensland. The proposition is that stronger connections between these areas, and especially between resident primary care providers and non-resident dental practitioners and oral health services could contribute to community oral health gains.

The methodology for the research approach for this study used qualitative/descriptive case studies, via face-to-face and phone interviews, with eight rural communities across Queensland. The communities chosen for the study were those that met the study criteria and were identified by the Chief Dental Officer of Queensland. These communities presented with oral health care as a significant problem as there was no resident dentist/dental surgery, at least one general medical practice, a health care facility and a pharmacy in the community.

Data were collected using semi-structured interviews where the main interview questions included: information on the number of people who requested oral health advice or treatment, treatment/advice provided and their level of confidence with this, the communication the dental

and non-dental health providers had with each other and their views on strategies that could improve oral health in their community.

Narrative data were analysed in Nvivo 10 using thematic analysis. The validity and reliability of the data was ensured by the processes of triangulation, saturation, peer review and debriefing.

The next chapter of this thesis presents the results from the three separate case studies. The three case studies examine three different models of oral health care delivery. The first two case studies explore two different models of government oral health service delivery. The first case study uses a toll-free message bank central referral call centre, the second case study has a directly contactable centrally located public dental clinic which employs a recent dental graduate dental practitioner. The third case study examines another oral health care delivery model consisting of a philanthropic mobile dental service that delivers oral health care to several Central Queensland communities. The distinctions between some elements of the three case studies is not always clear as some features and characteristics are at times, quite transitory. This candidate examines the oral health services provided by the philanthropic mobile dental service by examining four communities visited by this service. The three communities from case study two are re-examined for data specifically relating to this service, and a community from a different Queensland district is added to form this third case study. This overlap between case studies two and three allows for the development of further interesting question scenarios relating to professional tensions that may develop when private and free visiting dental services compete for the same patient base. Each of the three unique oral health care delivery models is examined utilising the guidance provided by the conceptual framework for this study and in congruence with the aims of the study. The influences of these three different oral health care delivery models on eight rural and remote Queensland communities are presented in the next section of this research project in three case studies.

Chapter Four: Results

"However beautiful the strategy, you should occasionally look at the results"

Sir Winston Churchill (former British Prime Minister born 1874, died 1965)

This chapter presents findings relating to the challenges and barriers to accessing oral health care varied across the eight rural and remote communities sampled. The strategies suggested by participants to address these challenges varied across the communities. As the thematic analysis progressed, it became apparent that the separation of the communities into three descriptive case studies that received oral health care services by three different oral health care delivery models, would help to make sense of the data in a more organised way. The distinctions between the case studies was not always clear and the term "case studies' was an organisational and conceptual devise to help draw out features that were different to enable these to be examined.

Case Study 1 reports participant's views of oral health status and the oral health service delivery model for residents in one Queensland district where four rural and remote Queensland communities (towns A, B, C and D) received oral health care services from a public dental service. Referrals are triaged through a Central Referral Call Centre situated in the hospital of a larger hub community. This toll-free call centre is the only point of contact for the primary health care network to access oral health care for eligible dental patients from their communities at the government dental clinic. Dental patients from those four communities examined, who do not have a health care card, rely on sporadic fly-in fly-out visits from private dental practitioners or travel large distances to access oral health care from private dental practitioners in larger regional centres. Indigenous oral health services are also sporadic with occasional visits from a mobile dental service to Town D. Indigenous patients are able to utilise the government dental clinic for oral health needs.

Case Study 2 examines three communities from a different Queensland district (towns E, F and G), which access oral health care services from a government dental service where referrals are triaged directly with the government dental clinic personnel. Two government dental clinics are utilised in this oral health delivery model, with one being attached to a small medical care facility located centrally within the district and the second attached to a larger hospital in a bigger hub community. These two government dental clinics are serviced by a recent graduate dental practitioner recruited from a regional Queensland University. This new graduate receives mentoring from the long-term

resident private dentist in the nearby larger regional centre when he practices there for two days each week. Patients without a Health Care Card often travel large distances to access oral health care from this private practitioner. Indigenous patients access oral health services via the government dental clinics and receive a sporadic visiting Indigenous oral health care service. These three communities also receive a yearly visit from the NGO Mobile Dental Service.

Case Study 3 examines this philanthropic mobile oral health service delivery model in detail. It re-examines the three communities from Case Study 2 (Towns E, F and G) and introduces a new community (Town H). This oral health delivery model consists of a free mobile dental service operated from an 18-wheeler semi-trailer truck, jointly funded by an NGO and a privately-owned Queensland mining company. This philanthropic mobile oral health service offers oral health services to private patients, government eligible patients and Indigenous people at no expense to the patient.

The first case study presented in this chapter examines the ways that the rural primary care network from the first four communities deal with oral health problem presentations for their patients, in the absence of a resident dental practitioner.

4.1 Results Case Study 1: Queensland District 1

> *"The single biggest problem in communication is the illusion that it has taken place" George Bernard Shaw (playwright born 1856 died 1950).*

Case Study 1 is made up of four communities receiving oral health care services from a public dental service where referrals are triaged through a Central Referral Call Centre. Residents from the four communities studied, who possessed Health Care Cards, are referred via phone message, for treatment at the government funded dental clinic. Non-Health Care Card patients access private dental practitioners by travelling to surrounding remotely placed private dental practices or access infrequent fly-in fly-out private dental practitioner visits. Indigenous dental services are offered irregularly by a mobile dental unit, and sporadic school dental services address oral health care needs of children.

The participants' views on the strengths and weaknesses associated with the oral health delivery systems for their communities are reported for this first case study.

The characteristics of the four study sites and 39 participants are presented and the collective data set has been analysed and separated into themes and subthemes, which present a picture of the situation in relation to oral health care delivery in these first four communities. The results answer the research questions underlying this study. The research questions ask about: the types of oral health problems; the challenges and barriers faced by the four communities in relation to oral health care access and provision; the communication and referral pathways between the rural primary care networks and dental personnel; the interest in dental technologies to improve interprofessional collaborations and; the possible strategies to improve oral health provision and access for people in these four Queensland communities.

4.1.1 Characteristics of oral health service provision in Case Study 1

Four of the eight communities selected by the Chief Dental Officer, in this rural and remote region of Queensland, are examined in this first case study (Figure 4.1).

These four communities, in the absence of a resident dental practitioner, refer their eligible patients (those with a means tested Health Care Card) with dental emergencies to a Central Referral Unit in the remotely located larger hub community. The Central Referral Unit reported sending a government dentist to Town D (once a month) and Town C (once every 3 months), but the members of the primary care network in Towns D and C who were interviewed reported that this was not often enough. Eligible patients from Town A and Town B must find their own transportation to the to access oral health care from a centrally located larger community called a "hub community".

Government vouchers are issued to those eligible patients who are unable to see the hospital-based government dental practitioner to enable them to attend a private dental practitioner in a larger regional hub centre. On rare occasions, fly-in fly-out private dentists attended to people in Towns A, B, and C. A visiting Mobile Indigenous Dental Van visited the area once a year, but this service recently ceased operation. At the time of the interviews, the school dental service provision was sporadic as the dental therapist (who usually supplied dental care) was on maternity leave, usually the dental therapist would visit Towns A and C, albeit rarely. Children in Town D were not treated by the school dental service, and the children had to travel to the regional hub community with their parents for treatment. Patients from all four communities who did not possess a health care card were encouraged to travel to private dentists in capital cities and large regional centres for treatment.

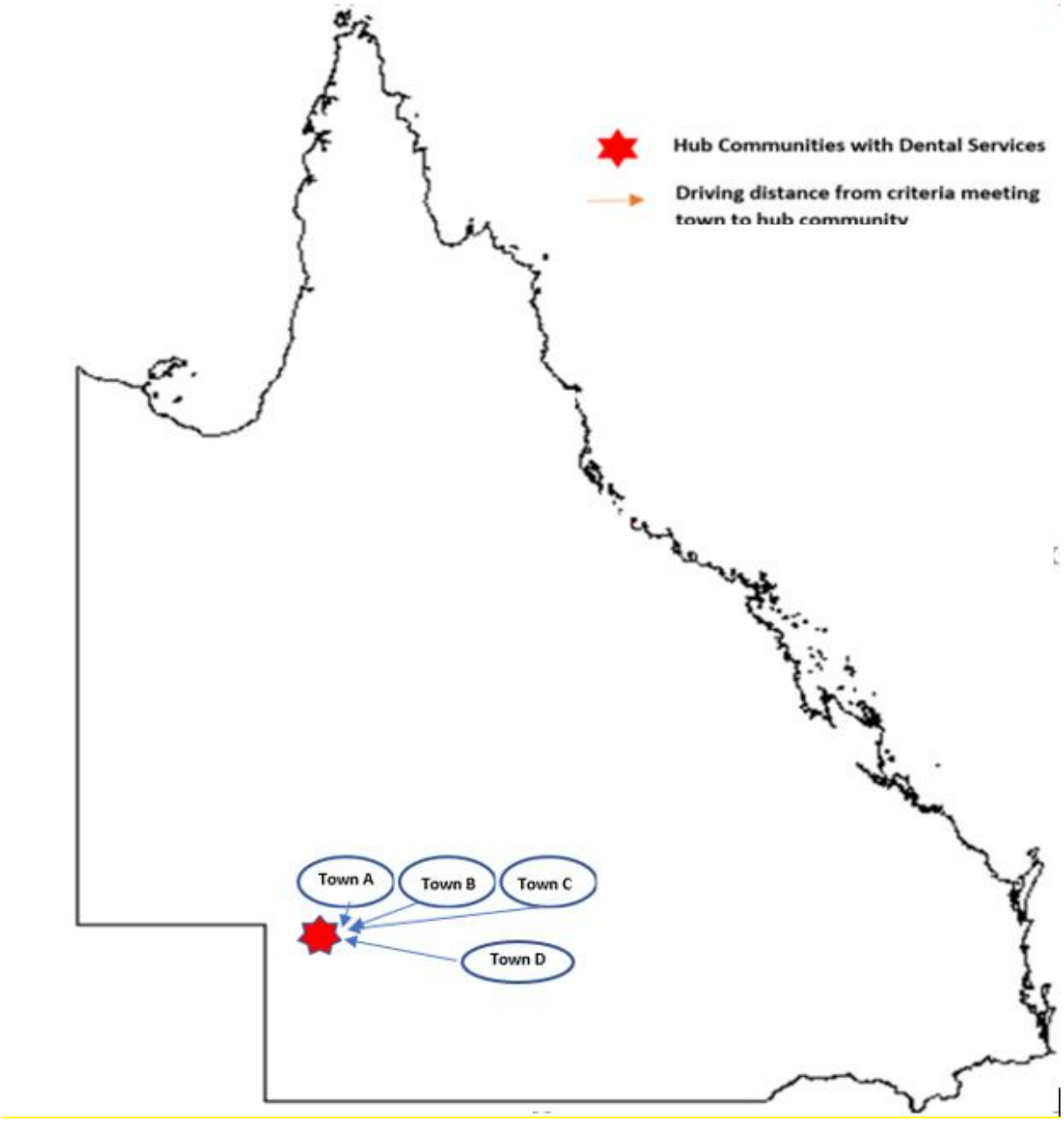

Figure 4.1: Map of the location of the four de-identified communities included in Case Study 1.

4.1.2 Characteristics of the participants

Thirty-five primary health care providers and four dental personnel with experience in providing oral health advice and treatment to patients in the four communities were included in this first case study. Of the 39 participants, 24 were female and 15 male. Eighteen participants were aged over 40 years, and 21 participants were 18 to 40 years of age. Almost half of the participants (19) had worked in their current practice for 1-5 years, and six for more than 5 years. The key characteristics

of the participants are shown in Table 4.1. The full table of de-identified participant characteristics is available in Appendix H.

Table 4.1: Characteristics of participants in Case Study 1 (n=39)

Characteristics	Number of participants (%)
Sex	
Female	24 (62 %)
Male	15 (38%)
Age groups (years)	
18-30	9 (23%)
31-40	12 (31%)
41-50	10 (26%)
Over 50	8 (20%)
Primary Care Provider	
GP	12 (31%)
Pharmacist	6 (15%)
Director of Nursing	3 (8%)
Child Health Nurse/Nurse	3 (8%)
Practice manager	4 (10%)
Receptionist	3 (8%)
Speech Therapist	1 (3%)
Medical Student	3 (8%)
Dental Care Provider	
Dentist	3 (8%)
Dental nurse	1 (3%)
Years in current practice	
< 1 month	5 (13%)
>1 month to 12 months	9 (23%)
>1year to 5 years	19 (49%)
>5 years	6 (15%)

4.1.3 Themes and subthemes

Four major themes emerged from the data, which were: the challenges of receiving effective oral health care access and provision, inadequate communication and referral pathways between dental care providers and the rural primary care network, interest in dental technology to enhance

interprofessional communications, and strategies to improve oral health care access and provision. Many subthemes emerged within these major themes and were grouped in order of the number of times they were mentioned by each different participants. Some participants expressed several different views and these themes and subthemes are listed in Table 4.2.

Table 4.2: Common Themes and Subthemes for Case Study 1

Themes	Subthemes (frequency of different responses by participants)
Challenges faced	• Oral Health Presentations to the RPCN (35) • Oral Health Advice Given by the RPCN (35) • Confidence in providing advice by the RPCN (20) • Rural Dental workforce shortages (20) • Travel and cost (15)
Communication and referral pathways	• Interprofessional collaborations between RPCN and dental care teams (24) • Referral pathways (25)
Interest in Teledentistry to enhance interprofessional collaboration	• Intraoral camera/teledentistry (9) • Teleconferencing (1)
Strategies to improve oral health access and provision	• Other oral health service provision types (46) • Oral Health promotion (31) • Emergency dental upskilling for the NDRPCN (19) • Increasing dental workforce (17)

4.1.3.1 *Challenges Faced*

Non-dental participants were asked about their experiences with oral health presentations in the absence of a dental practitioner. Challenges explored included: the types and frequency of oral health presentations (35), the oral health advice and treatments commonly provided (35) and their confidence in providing this advice (24). The views of dental personnel participants were also included to uncover further challenges on accessing timely oral health care access and provision, these views included: rural dental workforce shortages (18), and the costs of accessing dental care associated with large distances to travel and treatment costs themselves (15).

4.1.3.1.1 *Oral Health Presentations to the non-dental rural primary care network*

The types of oral health problems presenting to the rural primary care network participants in the four selected Queensland communities and the frequency of these presentations were examined.

The most common oral health problems reported by the rural primary care participants were; toothache (25), abscess (21), oral/gum infections (16), sore mouth (6), broken/ lost fillings (4), trauma (4), and dental care product advice (4).

The most common response to the type of oral health problem that commonly presented to the primary health care network participants was for the generic term "toothache".

> *I see people that have had dental pain again, and again on the scripts. I look through their notes and see that they had dental pain here, here, and here. It is very common to see awful dentitions on average in [Town A]. It would be several times a week that I'd see patients either in the hospital, the surgery or after hours who have dental pain, or other nasty dental swelling. (General Medical Practitioner 11)*

> *The most common things I see are toothaches and abscess. (Pharmacist 1)*

Many Medical Practitioners in Hospital Emergency Departments reported that many oral health presentations were for dental abscesses.

> *Major abscess problems are the most common presentation. (Hospital General Medical Practitioners 1-5, in a group interview)*

Often administration staff at front desks of medical facilities reported patients requesting appointments for oral health issues relating to toothaches and oral infections.

> *People ring up and want an appointment for toothaches and oral Infections. (Medical Receptionist 1)*

Members of the non-dental primary care network often described oral health issues as "sore mouths".

> *We see ulcers, gum infections, oral infections, and sore mouths. (Pharmacist 3)*

A few participants reported incidences where patients presented with broken teeth requiring pain relief in the absence of timely access to a dental practitioner.

> *We see a lot of adults and children usually with pain, abscesses or broken teeth. They come to us because there is not a dentist and they need pain relief or antibiotics. (Child Health Nurse 1)*

Participants reported incidences of trauma presenting to after-hours hospital departments.

> *We see patients after hours with toothache needing pain relief, trauma, and oral infections. (General Medical Practitioner 12)*

Four pharmacy participants reported patients requesting oral health product advice in relation to dental issues.

> *I see ulcers, toothache/pain relief, wisdom teeth eruptions, oral infections, swollen/bleeding gums, toothpaste advice and tooth whitening etc. (Pharmacist 2)*

General Medical Practitioners reported seeing people with oral health problems from 'everyday' to 'one per month', hospitals from 'very common' to 'four in a month', and pharmacies from '10–15 per week' to 'one a month'. Table 4.3 shows the frequency of these presentations.

> *The number of presentations is important to justify a dentist. (General Medical Practitioner 13)*
>
> *We estimate that 2-3 people a week present to the Emergency Department with dental issues. (Hospital General Medical Practitioners 1-5, in a group interview)*

Table 4.3: Frequency of oral health presentation to non-dental care providers

Frequency of Oral Health Presentations to the Primary Care Networks in Case Study 1		
Community	**Practice Type**	**Frequency**
Town A	Private Medical Practice	Several times a week
	Public Hospital	Very common
	Pharmacy	1 per day
Town B	Private Medical Practice 1	Everyday
	Private Medical Practice 2	1 per week
	Private Medical Practice 3	5 in 3 weeks
	Hospital	1 every 2 months
	Pharmacy	1 a month
Town C	Private Medical Practice 1	2 in 10 days
	Private Medical Practice 2	5 per week
	Hospital	4 per month
	Pharmacy	1-7 per week
Town D	Aboriginal Health Centre	1 per month
	Hospital	2-3 per week
	Community Health Centre	Everyday

	Pharmacy	10-15 per week

Delay or failure of the patient to obtain follow-up treatment with a dentist, meant that participants often saw the same patient several times with the same problem. Participants reported that dental issues, left untreated for long enough, became medical issues that required hospitalisation.

> *We see elderly people who are not wearing dentures because they are ill fitting so that affects their diet and they can't get them fixed or maybe they break a tooth that holds the plate in. I see them multiple times and you are just aware of it because different ones are not using their dentures or have broken teeth. (Community Nurse 1)*

When the dental practitioner did visit the communities, their time was often limited, and emergency rather than preventative and comprehensive dental treatments were given priority. The non-dental primary care providers observed that this perpetuated the poor state of oral health in their communities. The participants described how they understood the requirements for preventative dentistry to stop the dental disease cycle.

> *When the dentist is here it is for emergency time and all he can do is pull teeth out. He has so much emergency work to do and so that is what is happening. (Director of Nursing 2)*

> *It's like band-aid dentistry, they're just pulling teeth out and waiting for the next problem, rather than doing check-ups. There is no way you'd be able to do it any differently than that out here with the time constraints. (General Medical Practitioner 11)*

A dental practitioner expressed frustration with the government dental clinic philosophy of dental treatment options where emergency dental treatments were the main options available to them. Comprehensive and preventative dental treatments were not possible due to the volume of patients requiring emergency treatments such as extractions.

> *I tried to do some pretty comprehensive dentistry but again in the public dentistry arena you only treat emergencies. You knew that the next time you got to see that patient in the public system it would be to do another extraction. It's a crazy system that they have in place and it's going to take a fair few extractions on people before you can get to the preventative dentistry phase. It's emergency stuff. It's not comprehensive dentistry. The patients know also, that's all they expect. (Private Dental Practitioner 2)*

4.1.3.1.2 *Oral Health Advice Given by the non-dental rural primary care network*

The oral health advice and treatments suggested by primary health care providers, to patients with an oral health issue in the absence of a dental practitioner, was influenced by their personal and professional experience and background. The common treatments and advice given were: refer to a dentist (29), provide short term pain relief (23), refer to a general medical practitioner (16), provide antibiotics (16), provide oral health care advice (6), referral to the Central Referral Unit (6), provide antibacterial medication (4), hospitalisation (4), referral to a dental auxiliary (2), referral to a Hospital Emergency Department (2), and give a dental local anaesthetic (2).

The most common action taken by the rural primary care network for patients with oral health issues was to advise the patient to see a dental practitioner.

> *We suggest the patient sees a dentist, we provide prescriptions for antibiotics and give short-term pain relief and hospitalisation, if necessary (Hospital General Medical Practitioners 1-5, in a group interview)*

Short term pain relief was offered as the most common proactive treatment option by the rural primary care network.

> *Then all you can really do then is give them something for pain and then if you think they need antibiotics and then make sure they can see a dentist. (General Medical Practitioner 12)*

If there is no resident dental practitioner available, then non-medical practitioner participants reported sending patients with emergency dental presentations to General Medical Practitioners.

> *All I can do is get them into the doctor. You can tell them when the dentist is in town and that they need to get themselves to the dentist. (General medical Practice Manager 2)*

> *I work for one of the local General Medical Practitioners and we see a lot of adults and children usually with pain. Abscesses or broken teeth. They come to us because there is not a dentist and they need pain relief or antibiotics. We see a lot of them. (Child Health Nurse 1)*

The provision of antibiotics to treat dental infections, was reported by 16 participants as a suitable treatment option. Prescriptions for oral antibiotics or hospitalisation with intravenous antibiotics were the most commonly reported delivery methods.

> *Town D is very fortunate in that they have private medical centres and a pharmacist. They have the hospital there with 3 or 4 doctors who can perform quite a few different*

procedures and so they are fairly well equipped with doctors and chemists so if anyone gets a toothache out there then they can go to the doctor or pharmacist and they all prescribe amoxicillin and Flagyl and painkillers and say here take these and it will all go away. Sometimes it does go away until a dentist can arrive in the community. (Private Dental Practitioner 2)

Participants reported instances where they had issued oral health care advice to patients with oral health issues based on their own personal experiences.

I recommend people go to the hospital for a script (Amoxil and panadeine forte), see a dentist or see a doctor. I give oral hygiene advice, provide non-prescription antibacterial medicine, provide short-term pain relief and I provide advice based on my personal experience. (Pharmacist 2)

The participants described their pathway for referral to a dental practitioner as being via the "Central Referral Unit" in the major hub community.

You treat that to the extent you can then you refer that to the Central Referral Unit. With a lot of allied health now we can't refer directly but have to go through Central Referral Unit in a major hub community. (General Medical Practitioner 11)

I refer to them to the 1300 number and never get feedback. (General Medical practitioner 10)

I send them to the nurse or to the doctor or ring 1300 CRU. (Medical Receptionist 1)

Four pharmacists responded to oral infections by recommending antibacterial medications.

All I can do is to give oral hygiene advice, provide non-prescription antibacterial medicine, provide short-term pain relief, and provide advice based on my own personal experience. (Pharmacist 2)

General Medical Practitioners described how they sometimes hospitalised a patient with a dental abscess and administered intravenous antibiotics if the patient was medically unwell.

We suggest the patient sees a dentist and provide prescriptions for antibiotics and we give short-term pain relief and sometimes hospitalisation. (Hospital General Medical Practitioners 1-5, in a group interview)

It depends on how unwell they are, whether basically you just give them oral antibiotics or whether they need occasionally intravenous antibiotics. (General Medical Practitioner 11)

In the absence of a resident dental practitioner, the rural primary care network reported that they asked the long term local resident dental assistant attached to the government dental clinic, for advice, triaging and appointment facilitation.

> *We suggest the patient sees a dentist or another type of dental practitioner. We give oral hygiene advice and suggest that the patient sees a doctor. We ring the dental assistant from Town D. (Speech pathologist)*

Participants referred patients with dental emergency presentations to emergency departments in hospitals in the absence of a nearby oral health care practitioner.

> *Drain the abscesses, provide prescriptions for antibiotics, provide short-term pain relief and refer to ED. (General Medical Practitioner 1)*

Medical practitioner participants demonstrated more proactive actions to treatment options and some practitioners reported having administered dental anaesthesia to patients with dental pain.

> *I give a dental injection and ask them to see a dentist. (General Medical Practitioner 10)*

> *In one community, they are quite clever, and one doctor out there gave a Marcaine block to give the patient relief overnight. (Dental Practitioner 3)*

4.1.3.1.3 *Confidence in providing advice by the RPCN*

Participants interviewed indicated their varying levels of confidence in dealing with dental issues for their patients in the absence of a dental practitioner. The responses varied from very confident (8), confident (4), not confident (7) to very unconfident (1).

Some primary care providers interviewed indicated that they were very confident in providing oral health advice and treatment within their scope of practice, in the absence of a resident dental practitioner.

> *I'm very confident in providing emergency dental advice. (General Medical Practitioner 14)*

> *I'm very confident. (Director of Nursing 3)*

One pharmacist responded that they felt confident offering advice about soft dental tissues but not about the teeth.

> *I am confident with gums but not confident with teeth. (Pharmacist 4)*

However, some members of the interviewed primary health network acknowledged that they were sometimes not confident in dealing with oral health presentations.

I am not confident enough in providing oral health care advice. (Pharmacist 3)

Sometimes not confident enough. (Hospital General Medical Practitioners 1-5 and 1 private medical practitioner in a group interview)

One General Medical Practitioner expressed a concern that their knowledge of treatment options for oral health care issues was limited to the provision of painkillers and antibiotics.

I must admit, I'm not very knowledgeable; I just think, 'they need painkillers, antibiotics and a dentist'. I certainly don't really know much else. (General Medical Practitioner 12)

4.1.3.1.4 *Rural Dental Workforce Shortages*

Dental practitioners and members of the primary health networks who provided treatments to the four rural and remote communities selected in this case study reported that the challenges to effective oral health care access were due to local shortages of dental practitioners and dental auxiliaries, including dental technicians and dental therapists.

Private dental practitioners were reported to only provide oral health services to the four communities intermittently and the government dental practitioner only visited Town C once every three months and Town D once a month. A participant who had been in the community for a long time observed the changes in the dental workforce over time.

When I came out here to Town A twenty years ago, there was a dentist at the hospital and a private dentist in town, and then when he left, there was still another private dentist in town as well as a dentist in the hospital, and then it got worse and worse. Then there was no private dentist, just the hospital dentist occasionally. (Director of Nursing 1)

Another participant mentioned that there were government dental clinics set up in some small rural and remote communities but there were no dentists to manage these clinics.

The government want to set up these dental clinics in small rural and remote towns and so they have all these wonderful facilities, but we just don't have the dentists to man them. (Private Dental Practitioner 2)

The participants commented on the difficulties in recruiting a dentist to a rural community.

Dentists are so scarce and if you could set up in a city, why would you set up in Town A? (Director of Nursing 1)

The dentist working in the [larger regional hub town] is leaving in January and his job has been advertised for 6-8 months with no applications. (Dental Assistant 1)

The shortages of other types of dental practitioners such as the school dental therapist and dental assistants, were also mentioned by the participants as disadvantaging the oral health status of their community's children.

> *The school dental therapist has not been around for 2 yrs. They just don't have the staff. That's the major problem. (Director of Nursing 2)*

> *I am expecting a dental therapist to recommence work after maternity leave. I only have one dental chair and so would like a dental van to be permanently on site for the therapist. I also need another dental nurse permanently to help me as I alone will be expected to assist both oral care providers. I will be working very hard with assisting the dentist, answering the phone, ordering supplies and sterilising all the equipment. I have grave concerns that without the proper number of dental nurses then mistakes will happen re infection control requirements. (Dental Assistant 1)*

Dental technicians were also reported to be unavailable to residents in the four rural and remote communities studied. Consequently services provided by them such as construction of new dentures and denture repairs were not possible in these communities.

> *Dental technician should be available. School dentist to come more regularly. School dental therapist has not been around for 2 yrs. (Director of Nursing 1)*

> *We need more dental technicians and dental therapists. (Hospital General Medical Practitioners 1-5 and 1 private medical practitioner in a group interview)*

4.1.3.1.5 *Travel and cost*

Large distances to access oral health care from remotely placed dental practitioners, coupled with the expenses associated with fuel costs and overnight accommodation, as well as expenses associated with dental treatment itself, were reported by participants to be prohibitive for their patients in seeking timely oral health care.

Travel: Participants described the difficulty some patients faced when the rural primary care network advised them to consult a dental practitioner that necessitated travel to a regional centre. They acknowledged challenges posed by distance and costs in fuel, and accommodation to patients accessing remotely placed dental care.

> *A lot of the patients haven't got the 'where with all' to travel the 200km to a dentist. It is too much fuel cost. (Private Dental Practitioner 2)*

> *They don't have a lot of money and a lot of them don't have a vehicle. They will put up with the pain rather than drive for 2 hrs and spend $400 on a tooth. (General medical practitioner 11)*

Participants acknowledged that it was expensive to travel to see a dentist for not only low income people but also for middle income earners. Family commitments meant that sometimes entire families needed to travel with the patient to access oral health which added to the expense of travel.

> *It's expensive for middle income families to travel to the dentist. (Speech Pathologist)*

> *Even though there may be a service in [larger outlying hub community] it might be a low-income family it's driving there and driving back. It's expensive to do that. (Community Nurse 1)*

> *If they need to have the teeth removed, they have to go to [larger outlying hub community] and the families have to get up there and stay in the town and that is really hard and expensive to do. (Child Health Nurse 1)*

Residents without a car or older residents who had to rely on their family and friends for transport, were reported by participants to find travel to a regional centre more difficult if there were no established public transport systems to that place.

> *People go up to [larger outlying hub community] which is two hours away, and that is quite hard for some people because it's the cost of travel. And there's no PTS (public travel assistance subsidy) for dental treatment, as we know. And then they pay for the treatment up there, if they haven't a Health Care Card - it's pay on the spot. People don't really mind doing that, if it fixes their teeth but of course, it's only for the people who can afford it that do this. (Director of nursing 2)*

> *Some low-income people don't have a car and the nearest dentist is over 200km away and there is no public transport to either of those places. (Indigenous Health Care Worker 1)*

> *With the aged and elderly with tooth or denture problems, they have to either get themselves to [larger outlying hub community] and that means relying on family or friends. (Community Nurse 1)*

Cost: The cost of oral health care itself, was also described by some participants as being a prohibitive factor to attending regular dental appointments.

> *It is the cost factor; they just can't afford to go to the dentist regularly. (General Medical Practitioner 12)*

4.1.3.2 *Communication and referral pathways*

To understand the effect that interprofessional communications between the primary care network and dental practitioners had on oral health service provision in these four rural and remote communities, it was necessary to examine three specific aspects of this process. Communications were explored between the rural primary care networks and dental personnel in terms of: interprofessional collaborations (24) and referral pathways (12).

4.1.3.2.1 *Interprofessional collaborations between the non-dental rural primary health network and dental care teams*

Medical and oral health are intimately linked and effective interprofessional collaboration is necessary for overall patient health. Only a few participants from the primary care network recognised that interprofessional collaborations would enable effective patient medical information sharing to improve patient outcomes.

> *I guess the best thing would be if people were trying to stop dental and medical being mutually exclusive. (Practice Manager 2)*

> *You have to be aware of what medical things can affect the teeth we need to be more aware of dental issues. (General Medical Practitioner 12)*

One participant described how the oral health and the systemic health of patients had similar social determinants linking both oral and medical health.

> *The lifestyle diseases are linked to oral health. Diabetes and chronic disease is high in this area, due to lifestyle choices. (Director of Nursing 2)*

Communications between oral health care practitioners and the rural primary care networks were categorised in two ways: examples of both good (4) and poor (13) interprofessional collaborations were collected, and secondly the mechanisms for the notification of the dental practitioner's arrival in the communities were examined.

Good interprofessional communication: Four examples of good interprofessional communications between the primary health network and visiting dental practitioners were reported in these rural and remote communities. There was one example given of a dental practitioner visiting a pharmacy to meet the pharmacist.

> *A dentist dropped in this pharmacy once and I talked to him. (Pharmacist 5)*

The dental assistant from the government dental clinic had actively engaged with a community nurse to offer oral hygiene instruction to children from a kindergarten in one of the four communities included in this study.

> *The dental assistant has loaned me some dental education stuff, they have some little animals and tooth brushes and the dental assistant will come with me and we will try and do some things at Kindy and playgroups. And I send a note home for the parents telling them what we have learnt today, telling them to clean the teeth till the age 8 and so on. So, we try. (Community Nurse 1)*

One dental practitioner described the successful interactions between the young graduate government dental and medical practitioners who lived in the same hospital quarters.

> *The relationship between the medical people out there is very friendly because they all know each other. Often, they are young people and they associate together especially in the dental world where the dentists live at the hospital in, a major hub community, if they are employed by the state government. So, the dentists and intern doctors live together and so there is a pretty close association in that regard. The smaller the community I think the better they all know each other. (Private Dental Practitioner 3)*

One participant described how patient information sharing between dental practitioners and General Medical Practitioners was more successful when the "Chronic Disease Dental Scheme" was in operation.

> *I introduced myself to the pharmacist and I knew the doctors from the hospital. The Chronic Disease Scheme was still going when I was out there, so I got to communicate with them via e-mails and letters with a few doctors there. I didn't actually meet them all in person but just communicated about patients with various diseases. (Private Dental Practitioner 2).*

However, some members of the rural primary care network did not feel that they could contact visiting dental practitioners in their own communities, as they had not established a relationship with them and consequently, they contacted their own personal dentists in capital cities for advice and referrals.

> *When we were doing the Chronic Disease Scheme, I would contact my personal dentist in Brisbane simply because that is who I was going to for the last 25 years and I would say...who do you recommend? So, I use their network. (Medical Practice Manager 2)*

> *I make an appointment for patients to see a dentist in [larger regional hub town]. I know the dentist there and it is easy to refer a patient to this dentist. (Receptionist 2)*

Poor interprofessional communication: Examples of ineffective interprofessional communications or relationships were presented by twelve members of both the dental and medical professional disciplines. These participants attributed this inability to form relationships to the dental workforce shortages.

> *It would be different if you had a relationship with the dentist like if we had a local dentist here you might ring them and say could you fit this patient in, or what do you think about this but there is no relationship! (General Medical Practitioner 12)*

A few participants reported the infrequent nature of interprofessional communications.

> *The doctors or nurses might ring up and tell us what happened. But most of the time they just provide antibiotics and pain killers and then ask the patient to come into town for dental treatment. But yes, we do get some calls from time to time but mostly they just give antibiotics. (Private Dental Practitioner 1)*

> *I rarely speak to the dentist to solve an oral health problem for my client. It would be only to correct a script. (Pharmacist 2)*

The rural primary care network reported rarely communicating directly with dental practitioners to facilitate appointment making for their patients, they advised patients to contact dental practitioners themselves.

> *There is no networking! I never contact the dental surgery for advice on a patient. Patients have to arrange appointments for themselves. (Director of Nursing 1)*

> *Well we know from first-hand experience that it wouldn't make any difference if you did contact the dentist. They are never there after hours anyway. (Director of Nursing 2)*

> *I'd never even think of ringing a dentist now, I just tell the patient to ring and make an appointment. (Medical Practitioner 12)*

Participants described the nature of the "Central Referral Unit" as reinforcing this poor communication. The rural primary care network reported dissatisfaction with the lack of direct interprofessional communication associated with this system, as they reported that they would leave a message on an answering machine concerning patient details and reported never receiving feedback on patient outcomes from the call centre.

> *We refer clients to the Central Referral Unit in a major hub town and never speak to anyone. Just leave a message and never get feedback. It's very backwards. We don't like it. (Director of Nursing 2, Medical Practice Manager 2, General Medical Practitioners 11 and 12)*

Thirteen non-dental care providers were unaware of the availability of oral health services to their communities. In addition, variations between types and availability of services offered from district to district, made it difficult for new employees to know who was available to refer to, unless an established referral protocol pathway was specified.

> *I really need to know who I can refer to, so I don't promise stuff like I will make an appointment for you and there is no one to make an appointment with. We need to now know what you could get and who you could get it from. We had a dentist in the last town who would see private patients and public, but the public was quite confusing about funding about who was eligible and who wasn't. Not many young children were seen mainly adults. So, it varies from district to district. (Speech Pathologist)*

Notification of dentist arrival: The process for notification for the arrival of a visiting dental practitioner to the community was reported, by some of the rural primary care participants, to be informal in nature, or non-existent. Consequently a significant factor in the inability to formulate effective referral pathways and emergency appointment scheduling.

At the time of interview in Town D, a government dentist (who declined to be interviewed) from the larger regional hub town was visiting and treating dental patients in the community. The primary health network participants were unaware of his presence in their community.

> *Communication? I was not aware the dentist was here. (General Medical practitioner 10)*

> *And in that dental surgery (government dental clinic in Town D) we don't know when they come. They don't say ok yes, we are in this week, so that we can ring and say we have a patient here with an abscess or with whatever, who needs to be seen. We can't do that. (Indigenous Health Care Worker 1)*

Some other visiting dental services also failed to provide effective notification to the rural primary care network of their impending arrival.

> *If we knew when the dental van was going to be coming it would be good. (Child Health Nurse 1)*

> *We need to know when the Indigenous dental service is due to arrive. (Director of Nursing 1)*

4.1.3.2.2 *Referral pathways*

Participants from Case Study 1 of this research project reported that there were no effective formalised referral pathways for patients with oral health problems in their communities. In the

absence of a dental practitioner, the majority of the rural primary care network personnel interviewed felt no need to refer a patient anywhere as they felt confident to give appropriate emergency oral health care treatment themselves and they advised the patient to see a dental practitioner but made no arrangements to facilitate this referral. Four of the primary care providers referred patients to the Central Referral Unit which is located in a hospital dental clinic in a different location to the four study communities. Two non-dental primary care providers referred patients to General Medical Practitioners and nurses, two consulted their own private practitioners in capital cities for referral, and two contacted the dental assistant attached to the government dental clinic in Town A, who was a local resident.

Participants from the rural primary care network expressed their confusion as to the availability of services and requirements to access these services, particularly for those who were new to their communities. A clear referral pathway was requested by the rural participants to enable more efficient patient care.

> *We need a nice clear referral pathway for new people coming to work in the district. Even if it is a basic one saying you need this Health Care Card to access this service and what days they are available and any changes just so that you have got something because there is nothing at the moment. (Speech Pathologist)*

> *It is rather an odd system that we have in the bush. I don't know how it works exactly. We have a hospital dentist and he runs a clinic here for people who are on health care cards or a pension card but there is no one to treat private patients. (General Medical Practice Manager 2)*

Participants from these four rural and remote communities were dissatisfied with the lack of dental service provision in their communities and so many reported becoming self-sufficient when dealing with oral health care issues. Most non-dental primary care network participants (25), reported never asking anyone for advice regarding oral health care issues.

> *I never contact the dental surgery for advice on a patient. (Director of Nursing 1)*

> *I'd never even think of ringing a dentist, I just tell the patient to ring and make an appointment. (General Medical Practitioner 12)*

> *Well we know from first-hand experience that it wouldn't make any difference if you did contact the dentist. They are never there after hours anyway. (Director of Nursing 2)*

The Central Referral Centre was described by participants as a toll-free number on which patients or health care providers could leave a message to make an appointment to see the public dentist.

It was in a centralised location in a hub community hospital in a medium sized town distant from Communities A, B, C, and D. Twelve participants reported that they received no feedback on the patients referred to the centre for treatment and complained that 'phone messages were not returned'.

> *We all refer patients to Central Referral Unit in [regional hub town] but never speak directly to anyone. We can just leave a message and we never get any feedback. (Medical Practice Manager 2, General Medical Practitioners 11 and 12)*
>
> *The formal referral process is you do a referral to the Central Referral Unit in the major hub community. (Child Health Nurse 1)*
>
> *We can't even make appointments with the dentist now, we must go through the Central Referral Unit to [regional hub town]. It's very backwards. We don't like it. (Director of Nursing 2)*
>
> *You treat patients to the extent you can then you refer that to the Central Referral Centre. With a lot of allied health now we can't refer directly but have to go through the Central Referral Centre. (General Medical Practitioner 11)*

One participant stated that they only learned of the treatment outcomes when the patient returned to them with an unrelated medical issue.

> *Only if I see them [the patient] again or follow-up somehow…It is very unprofessional …not knowing what's going on. (Community Nurse 1)*

A dental participant explained the confusion surrounding the different perceptions of the operational mechanisms for the Central Referral Centre. Changes to the organisational arrangements of the Central Referral Centre have not been well explained to the rural primary care networks with the consequence being the breakdown of trust of the system by the referring primary care providers.

> *It is basically a 1300 number that referring practitioners ring up. It is a call centre to be precise, not a Central Referral Unit because in this Queensland district the Central Referral Centre is where you ring up to make a physiotherapy or occupational therapist appointment or maybe a child health nurse appointment or something like that. Dental does not work with the Central Referral Centre. The dental has a separate 1300 number that they must ring to make an appointment. But there has been so much change in the last one year that nobody really knows what needs to be done. They put a circular out 6 months ago (I work in Queensland Health and that's why I know about this and can tell you about*

> *it) saying that only the call centre could make the appointments but now they have changed it so that everybody can make the appointments. They are meant to make appointments for the whole of the district, so everybody rings that number not just the pharmacists and the doctors. (Private Dental Practitioner 1)*

The hospital dental assistant in Town D further described the inefficiencies associated with the Central Referral Centre citing the inexperience of the call centre answering person, who is not experienced in dental practice and dental triaging and is often not available to answer calls directly. This dental assistant also credits the lack of coordination from this central referral centre as being a major factor in the lack of notification of dentist arrival times in the communities.

> *On the topic of the network and communication between the two areas there is none. I feel isolated and very frustrated with the "system". The Central Referral Centre in [larger regional hub town] seems to be the problem. The phone is manned (rarely) by a person who has no dental training and so is not able to triage the seriousness of conditions for priority care. The Central Referral Centre is supposed to notify the hospitals as to when the dentist will be arriving in the outback towns. They are to contact the hospitals to arrange accommodation for the dentist and the dental assistant. Then the contact person at the hospital should then notify the rural health care network that the dentist will be in town. This doesn't appear to happen however. I often give out the numbers for private dentists in nearby towns. (Dental Assistant 1)*

The lack of feedback from the Central Referral Centre and lack of responses to written referrals to other dental practitioners have contributed to major interprofessional communication breakdowns and frustrations.

> *I write referrals to dental and just hope that something gets done with that. I never hear back. (Child Health Nurse 1)*

> *I only get feedback on dental referrals if I see them again or follow up somehow. (Community Health Nurse 1)*

Participants reported that they often advised their patients with oral health issues, to contact a dental practitioner directly or a medical practitioner if there was no dentist available.

> *We suggest the patient sees a dentist or another dental practitioner. We give oral hygiene advice and suggest that the patient sees a doctor. (Group Interview consisting of Child Health Nurse 1, Indigenous Health Worker 1, Community Health Nurse 1 and a Speech Pathologist.)*

Other members of the Primary Care Network rang dental practitioners in major capital cities for advice on referral pathways. These dental practitioners had often been the personal treating dentists for the participants, before moving to these remote communities.

> *I would ring my dentist in Brisbane simply because that is who I was going to for the last 25 years and I would say...who do you recommend? I then use their network. (Practice Manager 2)*

The Central Referral Centre 1300 number was a frustration to many participants when they needed immediate assistance with a dental emergency patient and consequently many participants had decided to bypass the "official" referral pathway and instead made direct contact with the hospital dental assistant, who was a long-term local community resident. This dental assistant was well liked, approachable and respected as the person to approach to directly access dental treatment in the four communities studied.

> *We suggest the patient sees a dentist or another dental practitioner. We give oral hygiene advice and suggest that the patient sees a doctor. We ring [Name of the Hospital Dental Assistant] for advice. (Group Interview consisting of Child Health Nurse 1, Indigenous Health Worker 1, Community Health Nurse 1 and a Speech Pathologist.)*

4.1.3.3 *Interest in Teledentistry to enhance interprofessional collaboration*

The interest was gauged from participants, both dental and non-dental, for the possible introduction of intraoral cameras into medical practice, to capture dental images to send via telecommunication networks to a remotely located dental practitioner, for triage and advice (teledentistry). The interest was then determined as to the inclusion of dental practitioners into collaborative teleconferencing meetings with other medical practitioners to discuss patient treatment planning.

4.1.3.3.1 *Intraoral cameras/Teledentistry*

When asked about their interest in the use of dental technology, four participants believed there was a possible application for this technology. They also however, described limitations to the usefulness of the technology because they explained that triaging the dental problem and treating the problem were different questions. They believed that definitive dental treatment still required an onsite dental practitioner with expensive and dedicated dental equipment.

> *Well you can get a lot of information as a dentist from an image but the nuisance of it is that you can be a smarty on the end of a phone but the guys there can't do any of the stuff that has to be done. At the end of the day I think more than likely that if there is a problem*

> *that we can see then they will still prescribe antibiotics and give pain relief, which is what they do now. (Private Dental Practitioner 2)*

Some participants saw the potential for the successful integration of the intraoral cameras into general medical practice and were willing to acknowledge a role for the technology, but still saw limitations.

> *It is a good idea and you see a lot more problems in the bush, but I don't know what to do other than antibiotics and pain relief. (General Medical Practitioner 12)*
>
> *Oral health camera had possibility (in a pharmacy practice). (Pharmacist4)*
>
> *Oral health camera using existing telehealth faculties could work well if we have staff trained in use of intraoral cameras and an on-call dentist somewhere to review the images. (Director of Nursing 2)*

Four participants showed no interest in the technology, describing it as too problematic due to internet issues, training issues for effective utilisation of the technology, and time constraints associated with limited workforce resources in the bush.

> *I'm not very interested in the oral camera idea as I am confident in dealing with oral health emergencies. (Director of Nursing 3)*
>
> *It's not just from the dentist point of view but from the doctor point of view as well. They would need to have the time to take the photo and then put it into an email and that is all extra time for them as well. They are too busy out there, so no. (Private Dental Practitioner 1)*

Some dental participants understood the possible advantages to dental triaging of oral health issues but recognised the limitations in treatment options available to the rural primary care network in the absence of a dental practitioner.

> *I can see some mileage in using oral cameras. Like if someone has broken a lingual cusp on a lower 6 and there's no decay and it is sharp on the tongue, that's the sort of thing that you could say to the nurse to just get an emery board and rub the sharp edge off. Then tell them it will be ok until they get a chance to come in and get the tooth repaired. But most people out there don't go to the dentist for fun. I think if they front up to those clinics it is for a pretty major problem, they would be pretty well in need of a dentist. I think that the cameras would have limited value personally. (Private Dental Practitioner 3)*
>
> *Well you can get a lot of information as a dentist from an image but the nuisance of it is that you can be a smarty on the end of a phone but the guys there can't do any of the stuff*

> *that has to be done. At the end of the day I think more than likely that if there is a problem that we can see then they will still prescribe antibiotics and give pain relief, which is what they do now. (Private Dental Practitioner 2)*

The logistical issues associated with poor internet speeds rurally were cited by one dental practitioner as being a major hurdle to acceptance of the uses for this type of technology currently.

> *It would not be a bad idea, but the thing would be that the networking (internet) would be very important. I don't know how clear the Skype image would be and how long it would take for dial up. And I have never heard of intraoral camera being linked to Skype (that would be wonderful if we could) and so we are probably talking about some sort of link up or email. There are only limited sizes of images that can be emailed, and it takes forever to open them up. (Private Dental Practitioner 1)*

One general medical practitioner thought that even if the oral health issue was diagnosed remotely, he would still only have the skills to do non-invasive dental treatments such as the prescription of antibiotics and pain killers.

Look it is a good idea (teledentistry) and you see a lot more problems in the bush. I don't know what to do other than antibiotics and pain relief. (General Medical Practitioner 12)

Thirty participants were unsure as to how they felt about the introduction of intraoral cameras to medical practices.

4.1.3.3.2 *Teleconferencing*

The inclusion of dental practitioners into existing telehealth communication networks was explored to enhance interprofessional communications between dental practitioners and the rural primary care network, and to consequently improve patient outcomes.
One participant, a director of nursing, saw the potential value of including dental consultations in existing teleconferencing events to allow professional collaborations for the benefit of patient's treatment planning.

> *See we have this thing here with the teleconferencing, if you can link dentists into the state-wide telehealth network that would be good. (Director of Nursing 2)*

However 36 respondents were unsure if teleconferencing with a dental practitioner would be of any benefit to patient outcomes.

4.1.3.4 *Strategies to improve oral health access and provision*

Four major strategies were suggested by the participants, to improve oral health care access and provision in the four rural and remote communities. These strategies included: increasing oral health service types (46), oral health promotion (31), education and training for the non-dental primary care networks (19) and increasing the dental workforce (17). Within these major thematic headings were many subthemes representing the participants' suggestions for improving the oral health situation for people in their small outback towns. These subthemes will be fully reported in this next section of strategies to improve oral health care access and provision.

4.1.3.4.1 *Other oral health service provision types*

When prompted, several different modes of service provision were suggested by participants, to improve oral health care provision for patients in the four communities examined. Multiple oral health care delivery strategies were suggested and included: the school dental service (18), shared private and government dental practice (13), Indigenous oral health care services (10), transportation for rural and remote patients to centrally located dental practitioners (6), an emergency dental hotline (3). mobile dental units (3), utilising dental students and new dental graduates (3) and, government dental vouchers to attend private dental practitioners (3).

School dental service: The use of dental care providers such as dental therapists and hygienists in the school dental service was reported as an effective way to treat children with oral health care issues. Sixteen participants voiced their concerns that this service was not operating smoothly at the time of the interviews but were all in agreeance that the service was a valuable mode of oral health delivery for children in Queensland.

> *The school dental therapist should treat the children again and oral health should be taught in school. (General Medical Practitioner 14)*
>
> *Get the school dental van to come. (Child Care Nurse 1)*
>
> *They don't send the school dentist down to Town D, so the kids don't get treated. There is a whole bunch of kids missing out in Town D and so they need more auxiliary staff that can treat the kids. (Private Dental Practitioner 2)*

Private and government shared practice: A combined private and public dental delivery model, was suggested as an alternative model by some participants, where dental practitioners could work part time for the public health service while retaining private practice within the same government dental clinic. This practice model was supported by ten rural non-dental primary health care participants and three dentists from the individual and group interviews.

> *I think if you could work it like the doctors do in the public hospitals where they are able to see private as well as public patients. (Private Dental Practitioner 3)*
>
> *An effective oral health delivery system is the mixed private and public dentistry model. (5 Hospital General Medical Practitioners in a group interview)*
>
> *A dentist should be allowed to work both in private practice and hospital. (Pharmacist 5)*

Dental practitioner participants mentioned that the model had been trialled in the past and commented on the advantages of the model. These advantages included attracting more dental practitioners to rural practice, offering financial incentives such as asking for no rent for the rooms, and only paying for wages and materials utilised when using the hospital clinic for private practice use.

> *That was how they got the dentists out there initially, it was the way of attracting them.*
>
> *That has always happened in the past until just recently (government dentists had the ability to private practice also). (Private Dental Practitioner 1)*
>
> *That's not a bad model to work on, to give the dentists the rights to private practice to work out of the same clinic. No rent for the clinic the only thing I had to do was pay my own wages to the staff when working on my private days. (Private Dental Practitioner 2)*

However, another dentist raised the concerns on the conflict of interest of the model.

> *I think if you could work it like the doctors do in the public hospitals where they are able to see private as well as public patients. But then it can get a bit distorted because they do bugger all publicly and do heaps privately and make their money that way. (Private Dental Practitioner 3)*

Indigenous Dental Services: Participants suggested the development of more Indigenous oral health services in the four rural and remote communities examined. Ten participants described this service as an effective oral health care delivery system to this population demographic within the communities. The existing service consisted of a mobile dental van that travelled around the district and treated the communities once a year. Non-Indigenous residents could also attend for a fee.

> *The local Indigenous Medical Care Clinic have a dental van that comes out every year. So, they were here in March this year so, I assume it will be the same next year. And they do see adults and children and they do see non-Indigenous people too. Indigenous people it costs $15 and for non-Indigenous people cost is dependent on the treatment, but it is still fairly reasonably priced. (Indigenous Health Care Worker 1)*

> *The dentist from the Indigenous Health Service used to work here, at the hospital, but they now send a van out, you know, which is a pity, as we have all the facilities ready. It's their choice to do it that way though. That's mainly for Indigenous people, but anyone can go; though it depends on your preference of course. (Director of Nursing 2)*

A courtesy bus or a car with a driver, was reportedly offered to Indigenous patients to access remotely located dental practitioners but this transport system was unavailable to non-Indigenous patients.

> *If patients are Indigenous, the Indigenous dental clinic has a courtesy bus to take them to [larger regional hub town] but if they are not of Indigenous descent then they can't use the bus. (Dental Assistant 1)*

> *I do know that a lot of patients from Town B used to get driven here in a car that was basically for Indigenous people. They were driven here to the public hospital but that hasn't happened for a while now. (Private Dental Practitioner 1)*

The proposed future establishment of Indigenous Oral Health Care Clinics meant that Indigenous people would have to travel large distances to access this free oral health care. One dental practitioner suggested that other non-Indigenous patients could also access treatment there for a small fee, and the possible consequence of this might be that that some patients would prefer to travel to this free service rather than support the resident dentist in a practice in the closest town to communities A, B, C and D.

> *Indigenous Dental clinics like the one proposed in Town D will make a lot of difference but having said that it might be good for some of the patients, but it is not good for us [private dentists]. People think well it is pretty much free or minimal cost and so they are willing to drive the 2 hours to go to Town D. I think everyone can go and there is a very minimal charge. At the end of the day people prefer that they don't have to pay much. (Private Dental Practitioner 1)*

Racial disharmony was described by one dental participant in association to the discrimination felt by non-Indigenous members of the community when accessing Indigenous oral health services.

> *Yes. The community gets divided. The Indigenous have no qualms about coming into the Queensland Health Clinic but the basic what you might call "whitey" won't feel right going into an Indigenous health centre for medical treatment. They feel that it is somehow inferior. There is definitely some racial disharmony going on between the different groups*

> *of people out there. You see there are 2 groups of people out there. The Indigenous are treated totally separate to the rest of the people out there. (Private Dental Practitioner 2)*

Transportation for the patient to the dental practitioner: Six participants commented that affordable transport options should be provided to enable patients to travel to and from the nearest regional centre to visit the resident dentist. The Indigenous services, as shown in the last section, had an established transport system for their own people and participants recognised the sense in this strategy to improve access to oral health care practitioners.

> *The tyranny of distance is what screws everything. I think it is a matter of having strategically placed dentists around the place, and Town D is a definite hub for that, but the smaller places in between are too remote. Don't bother wasting your money to put dentists in there. Three dental surgeries in Town D would offer good treatment and bus patients into this regional centre. (Private Dental Practitioner 2)*

A travel subsidy scheme to access oral health care services, was suggested by one member of the primary care network to allow transportation of some patients to regionally place dental practitioners.

> *People go up to the major hub community, which is two hours away, which is quite hard for people because it's the cost of travel. And there's no PTS for dental as we know. (Director of Nursing 2)*

Dental Emergency Hotline: Two participants suggested that an emergency dental hotline would help to facilitate better service provision by enhancing communication pathways.

> *Have a dental care "hotline" 24/7 (and a reimbursement scheduled worked out). (Pharmacist 2)*

> *To help communication have an emergency dental hotline. Establish a network because there is a separation between medical and dental. (General Medical practitioner 10)*

However, one dental practitioner pointed out that the advice given by a hotline would inevitably be to see a dental practitioner and to administer pain relief and sometimes antibiotics, and consequently be of little use.

> *I think that would work (an emergency dental Hotline phone triaging system) but you almost know what the advice is going to be, antibiotics and pain relief and get somewhere to get it fixed. (Private Dental Practitioner 2)*

Mobile Dental Units: the utilisation of mobile dental units to deliver oral health care to these rural and remote communities was explored, as Indigenous oral health care was already being

delivered once yearly to the four communities. Three participants suggested the increased use of mobile dental units to improve accessibility for oral health care.

> *The Indigenous service out there have got a mobile dental van and that is not a bad system. The bloke who runs that lives on the coast and comes in week on week off for whatever rotation he is on. He jumps in his truck with one assistant and drives around from community to community and treats the Indigenous people with toothache. That should be open to the whole community because something like that is all that is really needed. (Private Dental Practitioner 2)*

> *We need a dental van or Drover also, so that the outreach centres and schools, can be visited regularly by a dental therapist. (Dental Assistant 1)*

Dental Students and new dental graduates: Dental students are being utilised on compulsory rural rotations in hospital dental clinics as a mechanism to provide timely oral health care to rural and remote communities. Concerns were raised by several dental personnel who expressed concerns at this practice describing shortcomings in dental students' education due to time restraints imposed by compulsory rotations to rural hospital clinics in the final year of study.

> *When we were students in fourth and fifth year, we got to do some pretty fancy dentistry in the dental schools. We got to try our hands at different things that we could do, whereas now the fifth-year dental students just get palmed out to these regional centres and all they basically are doing are providing the government with some cheap emergency dental practitioners just doing extractions, and I am not sure if they even do sedative dressings. So, they are being dumbed down in their final year. (Private Dental Practitioner 2)*

The inexperience of new dental graduates was highlighted by some participants as a problem when practicing dentistry in rural and remote regions due to the demanding nature of dental emergency dentistry and the professional isolation that new graduates felt.

> *Select dentists with some experience behind them (not students) to recruit to rural areas (highly generalist). (Pharmacist 2)*

> *I don't think getting the new graduates out here will work. You need a competent dentist who knows what he is doing. I don't think young people who have just graduated, are capable of dealing with some of the complex issues. The young guys don't have this experience under their belt. (Private Dental Practitioner 2)*

One dental practitioner believed that new dental graduates would prefer to remain in large regional centres to practice dentistry rather than to begin their dental careers in isolated outback communities.

> *The situation is changing I am not denying that but particularly with the new graduates and those who graduate here in Australia, they do not want to go to the outback. They would rather stay in the bigger places and so there would never be an over demand of them in the rural areas. (Private Dental Practitioner 1)*

Government issued dental vouchers to attend private dental practitioners: Three participants described the use of government issued vouchers for patients with health care cards to access private oral health care practitioners for treatment. If the patient was unable to access dental care through a government dental clinic, then they were issued with a voucher for varying amounts to present to a nearby private dental practitioner to have the dental treatment completed.

> *Patients went to the clinic and if they were too busy or had no dentist there and the patient had a toothache then they would issue a voucher to the patient for about $240. This was to get the emergency treatment done and that was to cover the cost of an extraction or a sedative dressing. Then other patients had a voucher to get more treatment done. This was to the value of about $700. This was for restorative treatment like if they had 3 or 4 fillings to do. (Private Dental Practitioner 3)*

One private dental practitioner however, described instances of exploitation of this voucher system by patients and dental practitioners.

> *There is supposedly a system like that now in every town with a dental clinic. It's even happening in Brisbane. People go the dental hospital and are given a voucher to go to different dentists. It's a voucher up to even I think $800 or something like that. I have spoken to some of the dentists involved in this and they are doing some ridiculous stuff instead of emergency treatment. They are doing blatant cosmetic stuff and the patients have the inclination to go and get the vouchers to have this done. You know whenever the government gets involved in this sort of stuff there will be a bunch of people who know how to exploit the system. It happens in both camps both the patient and the dentist side. (Private Dental Practitioner 2)*

4.1.3.4.2 *Oral Health promotion*

Five strategies were suggested to improve oral health promotion in the four communities studied and included; the necessity to raise the community oral health awareness of residents in these communities (13), provision of free toothbrushes to residents (8), diet education for good oral health (6), dental screenings in medical appointments (5) and water fluoridation (2).

Raise community oral health awareness: Community oral health awareness was described by participants, as the understanding by residents of the importance of good oral health for overall medical health. Having had experience with patients with oral health problems, participants observed a lack of community oral health awareness due to minimal education in basic oral hygiene techniques and dietary requirements for good oral health, especially amongst parents.

> *Most families don't know that they should be actually cleaning the child's teeth after them, till about the age 8 and half of them mightn't even have toothbrushes. (Community Nurse 1)*

> *It may be lack of awareness and information. They may not realise that if their child is having anything in their bottle other than water, that there is the potential for decay. (Child Health Nurse 1)*

The importance of attending preventative dental appointments, was reported by one director of nursing to be misunderstood by parents as evidenced by poor attendance for these scheduled school dental therapist appointments by children. For example, a Director of Nursing said,

> *The school dental therapist was here last week, and they had a whole day for children and no-one came down. The parents don't bother bringing the kids down to the dentist. Oral health is just so very poor. (Director of Nursing 2)*

Most of the participants acknowledged the importance of introducing preventative oral health education into the school curriculum.

> *Oral health care should be taught in school. (General Medical Practitioner 14)*

> *Introduce dental care in the school program because teachers have a huge influence on children. (Hospital General Medical Practitioners 1-5 and Private Medical Practitioner 9 in a focus group)*

> *A lot of the people out there don't know the basics. Teach them that and a lot of the bigger dental problems go away. (Private Dental Practitioner 3)*

Free toothbrush provision: Eight participants from the communities interviewed reported that in their experiences, many people did not own a toothbrush. Oral hygiene instruction and the distribution of free toothbrushes and tooth paste was suggested as a promotional strategy to improve oral health for people in the region.

> *Provide free tooth brush and tooth paste. (Hospital General Medical Practitioners 1-5 in a group interview)*

> *My daughter is 8 and we had a little friend of hers stay over at our place about 12 months ago, and he is a little Indigenous boy. When it was time to go to bed I said, "oh well did you bring your toothbrush along?" and he said, "oh no I haven't got one". I had a spare and I gave it to him and he took it home, but he didn't think that was strange to not own a toothbrush. I think the family probably share a tooth brush (if they use one) and this is common in a lot of the families. (Indigenous Health Care Worker 1)*

Diet education for dental issues: Six participants commented that the promotion of a healthy diet for oral health was an important strategy to improve oral health in their communities.

> *So much soft drink and cordial and juice. There is still that way of thinking with the parents that it's juice not soft drink, so it is ok. And it is really hard trying to explain around that one. It is still sugar! High sugar intake is probably the biggest problem. (Indigenous Health Care Worker 1)*

> *Also, with school lunch boxes parents think fruit rollups are good because it says fruit. There are a lot of those terrible sticky, sugary foods but they are marked in such a way that they appear good for you. (Indigenous Health Care Worker 1)*

However, the participants acknowledged that there were barriers to this health promotion strategy such as the parents' motivation and uptake of healthy lifestyle promotion.

> *So, with the health promotion things we put on, the kids come but the parents never do. It is the kids you are trying to save but it is not the kids packing the lunch boxes. If you could have something that would entice the parents to come along that would be the big thing. (Child Health Nurse 1)*

Another barrier to the implementation of healthy diet promotion in rural and remote communities was the cost of fresh fruits and vegetables in rural communities.

> *Having a healthy diet is really difficult because fruit and veg's are really expensive out here compared to the cities. For low socioeconomic families, it is just so difficult to afford. (Speech Pathologist)*

Dental screening in medical appointments: Five participants suggested that dental screening in medical appointments might be a good way to identify dental conditions before they become a medical issue of significance. Participants suggested that the role in these appointments in triggering dental referrals would help to improve interprofessional collaborations and would be of importance for total health care for the patient.

> *Dental health is part of the four yearly healthy kids check through Medicare that General Medical Practitioners do. It's required to have a look at their teeth. They have a list of things they have to cover in each consultation, as well as talking about immunisations, looking at dental care would be a very good thing, just making them aware that soft-drinks aren't for little kids. (General Medical Practitioner 11)*

> *We can see children from birth to 18 years but probably my predominant area would be 0-5 years of age. Usually with school children we are just doing hearing screening and we are probably not lifting the lip on those children because that is a different examination but then we recover them again once they are in high school. (Child Health Nurse 1)*

A speech pathologist reported high incidences of dental decay in the children from the community and suggested a potential role for speech pathologists in identifying "at risk "children with oral health issues.

> *Lots of the kids we'd see in the kindergarten there, have rotten front teeth. You can quite clearly see it and they have lost their front teeth due to decay. We screen the kids at the Kindy for their speech we try and screen all the kids prior to the year they go to school. We screen them for speech and OT to make sure their fine motor and speech is all where it should be before they go to school. So, we do see a lot of the kids then and we do look at their teeth and their mouths to see how they are going with their speech. (Speech Pathologist)*

Water fluoridation: Water Fluoridation is an inexpensive and proven way to improve the oral health of a community (National Health and Medical Research Council, 2017) but was only mentioned by two participants when finding strategies to promote better oral health.

> *Fluoride should be in the water. (General Medical Practitioner 14)*

One participant understood the benefits of fluoride that occurred naturally in some bore water but said that few residents drank this water and instead drank tank water.

> *Most of the people here would only drink tank water. Is our water fluoridated? Maybe that impacts on our teeth being worse? Apparently, our bore water has great fluoride in it our dentist said but no one drinks it. (Child Health Nurse 1)*

4.1.3.4.3 *Emergency dental upskilling for the non-dental primary care network*

To improve their management of oral health problem presentations, non-dental primary care providers were asked their interest in participating in further education events about emergency dental techniques. Nineteen participants demonstrated interest in developing their emergency dental skills and oral health knowledge, with six participants being unsure of the relevance to themselves. Three participants showed no interest in further dental emergency technique upskilling.

Preferred formats for emergency dental upskilling courses:

Three different delivery models were examined to offer dental education in emergency dental techniques to the rural primary care networks in the four communities studied. Participants expressed varying levels of interest in differing education formats. These preferred formats included: courses and hands-on training (13), journal articles, newsletters, and a chapter in the Primary Care Manual (4), and online lectures with CPD's (2).

Work commitments and time restraints meant that 13 General Medical Practitioners, pharmacists, and other allied health care providers preferred shorter courses demonstrating practical skills for the management of oral health issues. One practical skill that medical practitioner participants felt would be of benefit to their emergency dental patients, was the administration of long-acting local anaesthesia to allow pain relief until dental diagnosis and treatment can be supplied by a dental practitioner.

> *Just having some basic better dentistry skills, and of particular relevance for me would be with nerve blocks. I mean the classic General Medical Practitioner's thing of giving amoxicillin and panadeine forte, you know, standard sort of treatment, but anything trickier I have had to do like an alveolar nerve block or even a narcotics course to keep pain under control. Not a lot of theoretical stuff but just practical stuff to buy us time before the dentist provided the definitive treatment. (General Medical Practitioner 11)*

One dental practitioner participant agreed that the benefits of basic education for the primary care network in emergency dental techniques, would benefit patients with pain of dental origin.

> *I think a better thing would be to show doctors how to give a block injection or how to use a spoon excavator to scoop out a bit of decay and stick a bit of cavit (a dental temporary*

> *restoration material) in the tooth or something. When you cover the tooth over like that the patient gets some relief. (Private Dental Practitioner 2)*

One medical practitioner however expressed a lack of enthusiasm for engaging in any dental upskilling as the pressures in treating more life-threatening issues, were challenging enough.

> *It's a question or priority, I'm too busy meeting more general health needs across the population, maybe when that settles it could be of interest but it's a low priority as I am the only doctor across this region. (General Medical Practitioner13)*

One director of nursing suggested that dental emergency treatment education could be included in the training for locum doctors, nurses, child health nurses, and midwives before they went on rural and remote rotations.

> *A better option would be to pay someone who might be prepared to put their doctors through something like that (dental emergency techniques training). Because they do all that training before they come, don't they? If nurses had some sort of education in oral health that'd definitely be a bonus, wouldn't it? Also, the child's health nurses could do with training, as they have a captive audience. Education for the midwives would be very good also because that's when dental care can be ignored because a lot of the community here bottle feed. (Director of Nursing 2)*

Other members of the primary care network including pharmacists, child health nurses, community health nurses, and a speech pathologist showed interest in improving their knowledge about dental issues for their patients.

> *Short course for other health professionals would help build confidence. (Pharmacist 2)*

> *Yes, we are interested. You never know it all there is always something new to learn. (Group interview with a Child Health Nurse, Indigenous Care Worker 1, Community Health Nurse1 and a Speech Pathologist)*

Four participants responded that their preferred method of post graduate education was via journal articles, newsletters and by reading the chapter in the Primary Care Manual available in all Queensland hospitals.

> *It wouldn't even need to be a whole article just one or two pages, just a little update. You're Doctor Weekly or Medical Observer or something like that or one of the magazines that come out free to the doctors. They often have articles on managing this and that so "managing dental" would be really useful. Most people have a read of that because it is the latest update. (General Medical Practitioner 12)*

> *Information should be put in the doctors weekly and medical observers. (General Medical Practitioner 14)*

One locum general medical practitioner was unaware that a comprehensive chapter on dental emergency techniques already existed in the Primary Care Manual.

> *A chapter in the Primary Care Manual would be good and even writing an article in one of the journals. Australian Family Physicians would be a good idea for basic dental care. It's probably been done before, but the nerve block thing would be great. (General Medical Practitioner 11)*

Two participants indicated that an online lecture, with continuing professional education merit points, was their preference for education access in their rural and remote communities.

> *I would be interested in an online course if it was CPD. (Pharmacist 5)*

> *Yes, I would be interested in a short course, online course. (General Medical Practitioner 15)*

4.1.3.4.4 *Increasing the Dental workforce*

Participants from these four communities suggested that a way to improve oral health in their communities would be to increase the dental workforce numbers which would include not only dentists but also other dental care providers such as dental technicians, dental hygienists, and dental therapists. Increasing the numbers of the entire dental team was described by participants as necessary to significantly improve oral health in the bush.

Attracting and retaining dentists rurally

Attracting and retaining dental practitioners to these smaller communities was widely acknowledged as a challenge to workforce number improvements. Ways of attracting dentists included promoting lifestyle factors and offering financial incentives. The importance of establishing and maintaining regular services by dental practitioners was reported by participants who suggested that a reliable service provision would be service one day a week, instead three-monthly visits.

> *Good working conditions for dentists, pay them properly, do not threaten their job, no restriction on work hours, flexible working conditions, do not make the paper work too difficult and give them more autonomy. (General Medical Practitioner 2)*

> *Give dentists financial incentives and accommodation and subsidise education for their children. (General Medical Practitioner 14)*

One director of nursing suggested the establishment of a dental practitioner fly-in fly-out locum scheme, like the one used to locate locum doctors for rural and remote communities. The need to improve facilities and accommodation were recognised as important factor to attract dental practitioners to rural practice.

> *Dentists are so scarce. And if you could set up in a city, why would you set up out west in Town A? They've got to work out some scheme. This is just my thoughts but a locum scheme, like you've got Ochre Medical who have doctors that come here for three weeks at a time and go somewhere else for three weeks, and I wonder if they could have dentists – who make really good money, $2000 a day, but you'd have to make it attractive, otherwise they're not going to come. And then we have the accommodation problem, we have to provide a reasonable kind of facility for them to live in while they're here. (Director of Nursing 2)*

Increased government funding for existing rural dental practitioners to make improvements to their practices was described as a strategy to encourage dental practitioners to stay in rural and remote communities. Five participants expressed their desire to see more government funding expenditure to dental services in their communities.

> *Need to offer financial incentives for the dentist by the government to encourage them to work in the community. (Pharmacist 1)*

> *The government needs to give more funding and support because it will make it a more viable option for them to set up practices as equipment is so expensive that if there was something I would really like to buy for the practice, but it is really expensive, then I won't get it. I would love to be able to provide "those type of services" to everybody. It is not necessary that you have to be in Brisbane or at the Gold Coast to provide those so, some type of funding for rural dentists would be good. (Private Dental Practitioner 1)*

Other oral health care providers

Participants described how dental technicians were required in their communities to perform denture repairs and construction; dental therapists and hygienists were required for school dental service continuation and dental assistants are required to assist the dental practitioners.

> *Dental technicians should be made available and the school dentist needs to come more regularly. The school dental therapist has not been around for 2 yrs. (Director of Nursing 1)*

> *We need more dental technicians and dental therapists. (Hospital General Medical Practitioners 1-5 in a group interview)*

> *A hygienist would get more of the ordinary stuff out of the way. You don't want a dentist wasting his time doing hygiene if you can get a hygienist doing that stuff. (Private Dental Practitioner 2)*

4.1.4 Summary

Case Study 1 of this research project examined the circumstances surrounding the oral health service delivery model utilising a Central Referral Centre for health care card holding government dental patients. Four Queensland communities were examined that met the study criteria of being RA4 or RA5 geographical classification and had an active non-dental primary care network with experience in treating patients with dental emergencies. Other oral health services available from private dental practitioners and Indigenous services were also examined. Twenty-two interviews were conducted with 35 non-dental care primary care providers and four dental care providers.

This case study was organised into four main thematic headings. These were the challenges to oral health provision and access, the examination of communication and referral pathways, the strategies to improve oral health in the region, and the interest shown in dental technologies to manage oral health presentations. Challenges to effective oral health care access and provision included an examination of the types of common oral health problems presentations, the oral health advice given by the non-dental primary care network, and the confidence in providing this advice. Participants then described the challenges associated with dental workforce shortages rurally, and the challenges faced by large travel distances to access oral health care and those associated costs.

Communication and referral pathways were explored to examine the nature of interprofessional communications. Examples of good and poor communications were presented and the notification processes for the dental practitioner's arrival in the communities were examined.

Referral processes between the rural primary care network and oral health care practitioners in these communities, were also explored. Participants explained the specific challenges to effective referral pathways associated with the Central Referral Centre, as the hub for all interprofessional communications. The difficulties and frustrations with the effectiveness of this referral pathway, were reported by rural primary care participants with examples given of poor referral pathways and limited feedback from the Central Referral Centre. The primary care network was generally aware of the location of the nearest dental practice for their community, but the majority never contacted that practice for advice. Only one third arranged an emergency appointment with a dentist for their patients.

The interest of the rural primary care network and dental practitioners in intraoral cameras and tele-conferencing/teledentistry, was explored to gauge their receptivity to using this technology to

enhance interprofessional communications and dental emergency triaging. The uses for the technology were appreciated by participants but challenges to infrastructure, such as internet speeds were reported as a significant issue to be overcome. Members of the primary care network showed more interest in teleconferencing and including dental consultations in telehealth/teledentistry.

Finally, strategies to improve oral health care access and provision were explored. Suggested strategies included; alternative service provision types, promoting oral health in their communities, education, and further training for the primary care network in emergency dental techniques, and increasing the dental workforce.

Different types of service provision were suggested to improve accessibility and provision or quality oral health care. These included: the school dental service, private and government shared dental practice, Indigenous oral health services, providing transportation for the patient to the dentist, a dental emergency hotline, mobile dental units, effective utilisation of dental students and graduates, and government issued dental vouchers to access private dental practitioners.

One suggested way to improve oral health promotion in the four communities was to raise community oral health awareness by promoting the importance of preventative oral health care, especially in school education programs. The provision of free toothbrushes and toothpaste was suggested to help in promoting good oral hygiene routines as respondents reported many families were unable to afford them. Community programs to offer diet education for good oral health, dental screening in medical appointments, and water fluoridation, were described by participants as further ways to improve the acceptance of the importance of oral health in the four communities studied.

Participants described the benefits associated with upskilling existing health care providers to offer oral health care advice and simple emergency treatments in the absence of a resident dental practitioner. The ways to deliver this education were explored and most participants suggested courses and hands-on training as the preferred delivery method. Other suggested delivery methods for this education were via journal articles, newsletters, and online lectures.

The final strategy that participants suggested to improve oral health care provision in their communities was to increase the entire dental workforce consisting of dental practitioners, dental therapists, dental hygienists, dental technicians, and dental assistants. Participants described ways to attract the dental team to their communities which included offering good lifestyle factors and financial incentives.

Another set of challenges to effective oral health care provision and access, referral pathways, and strategies to improve that situation is examined in the next case study of this results chapter. Case Study 2 of this research project explores three different communities that receive their government oral health care services by a different oral health care model.

4.2 Results Case Study 2: Queensland District 2

> *"Innovation is a popular contemporary term and there are none so innovative as people of the bush. Usually born of necessity, they find ways to make things work that suit their community" (Malone, 2016)*

4.2.1 Introduction

The second case study of this research project examines a different model of public oral health service delivery for a new group of three communities. Only those patients with Health Care Cards access oral health care services from a public dental service where referrals are triaged directly with the government dental clinic personnel. Oral health care is delivered from one of two government dental clinics attached to either a small outreach health facility centrally located in the district, or from a dental clinic attached to a larger hospital in the hub community. These clinics are serviced by a new graduate dental practitioner who was actively recruited by the Executive Director of Medical Services, from a regional Queensland University using the Voluntary Graduate Dental Placement Scheme, which ceased in 2016 (see Appendix A). This new graduate receives mentoring from a private dental practitioner located in a larger regional centre in a different location from the government dental clinic. Non-health care card holders access private oral health care from this private practitioner by travelling large distances to this larger hub community, and from sporadic fly-in fly-out private practitioners. The residents also receive intermittent school dental and Indigenous oral health services and a once yearly visit from the NGO Mobile Dental Service. This is a free dental service jointly funded by the NGO and a private mining company via its private foundation. The data relating to this philanthropic mobile dental service is examined in detail in the third case study presented later in this results chapter.

The major defining characteristic of the oral health delivery model for this second case study is the direction shown by the Chief Executive Director of Medical Services who is responsible for the area that includes the three new communities. He included oral health care in his plan for the overall health for the residents in these communities. Consequently, the director has actively recruited a recent graduate dentist from a regional Queensland University, to work within the region as the government dental practitioner. A newly established dental clinic is situated centrally within the district and is attached to a smaller outreach health care facility. The original dental clinic is attached to the hospital in the larger hub community where the government dental practitioner offers services for two days a week. The evolving oral health care delivery plan for this second Queensland district includes the use of a mobile dental vehicle fitted out as a dental surgery, to be driven by the dental practitioner, called a "*Drover*". This mobile dental unit is expected to deliver oral health care

to outlying communities within the district, in the future. At the time of interview, this plan is still in its initial stages and the mobile dental service is not yet operational. The young recent graduate dentist has been in the district for one year and is being mentored by an older more experienced resident private dental practitioner in the larger hub community for two days a week. This hub community is the base from which many of the other visiting allied health practitioners work.

4.2.2 Characteristics of oral health service provision in Case Study 2.

This second case study explores the oral health care arrangements in three communities in the second Queensland district that met the study criteria and were identified by the Chief Dental Officer of Queensland (Towns E, F and G). The characteristics of the three selected communities, Towns E, F and G are represented in Figure 4.2.

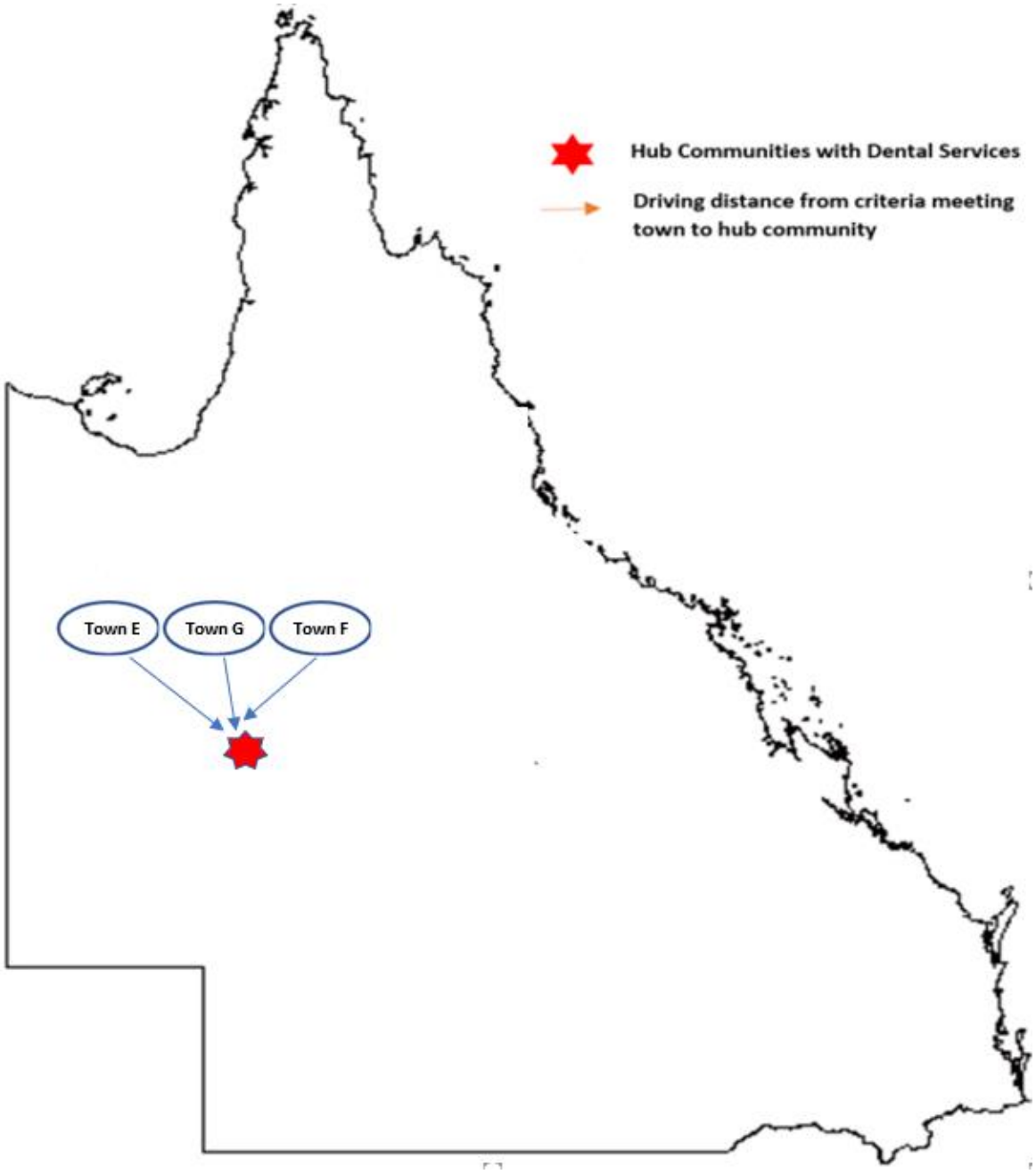

Figure 4.2: Map of the three communities examined from Case Study 2.

Each of the three communities has an active rural primary care network which consists of a general medical practitioner, a pharmacist, as well as other visiting auxiliary health care workers including three Indigenous health workers, a women's health community nurse, a mental health nurse and a child health nurse.

Oral health care provision occurs in several ways in this district: government dental care, private dental practitioner care, school dental care, Indigenous oral health services and free oral health services from the NGO Mobile Dental Service in association with the NGO. Dental patients with a

health care card are advised by the primary care networks to travel to one of two government dental clinics for treatment by the government dentist but have to find their own transport. The City Council in one outreach community has allocated funding for Greyhound bus fares to transport these patients to the government dental clinic. Government vouchers are given to those patients with Health Care Cards who could not be seen by the government dentist enabling them to attend the private dental practitioner. Participants indicate that some patients with dental issues, from all three communities, travel to their regular private dental practitioners in major regional centres, as they indicate a preference for continuity of care from the dentist of their choice. The school dental service is described as sporadic at the time of interviews due to understaffing. Indigenous-specific oral health care services have not visited the region for several years and Indigenous people access oral health care services through the public dental clinic. A private dental practitioner flies in twice a year to an aged care facility in Town F, at the private expense of the aged care facility, and triages referrals to the government dental practitioner. Another private practitioner flies into Town F once a month for three days and patients can travel to a private dental practitioner in a hub community remotely located from the three communities studied.

The primary health care providers from these three communities, in the absence of a resident dental practitioner, refer their dental emergencies to one of two government dental clinics. One located in a health care facility in a small hub community remote from the major hub community and another in this hub community where the private dental practitioner resides. This dental service in the smaller medical facility has only been established in the last year and the recently employed graduate dentist practices three days a week there and then travels to the Hospital Dental Clinic in the major hub community for two days a week. The resident private dental practitioner in the major hub community acts as a mentor for these two days a week and is contactable by phone during the other three days when the young dentist is alone in the smaller, remoter clinic. A mobile dental unit is being refurbished with a fully functional dental surgery and will soon to be operational. It is expected that the new government dentist and the accompanying dental assistant will then drive the small mobile dental clinic to outreach communities to offer oral health care.

Another private dental group from Brisbane has been assisting by visiting the small medical facility for the past four years in preparation for the proper establishment of this government dental unit. This service had ceased operation at the time of interview and the contract was not renewed since a permanent government dentist is now based in the region.

A free mobile dental service associated with an NGO and a private Queensland mining company, provides a third oral health care service which consists of mobile 18-wheeler semi-trailer truck equipped with modern dental equipment and two experienced dental practitioners and dental

assistants. The mobile dental service travels throughout some rural and remote Queensland regions and provides dental treatment to both public and private patients, free of charge. This service is explored in the third case study.

4.2.3 Characteristics of the participants

Twenty primary health care providers and four oral health care providers who had experience in providing oral health advice and treatment to patients in the three communities examined are included in this second Case Study. Of the 24 participants, 14 were female and 10 male. Nine participants are aged over 40 years, and 15 participants are 18 to 40 years of age. Three quarters of the participants (17) have been in the current practice for 1– 5 years, and six participants have been in the practice for more than five years. The key characteristics of the participants are shown in Table 4.4.

Participants were recruiting using the same procedures described in the methodology chapter. All 24 identified subjects accepted the invitations to participate in 19 interviews which included two focus groups (ranging from two to six participants). Participants had a choice to attend either an individual interview or a group interview. Individual interviews were conducted with 14 non-dental care primary care providers, including administration staff as they were responsible for triaging patient care. The government dental practitioner was identified by the Executive Director of Medical Services and the non-dental participants identified three other dental care providers, who were subsequently recruited through a snow ball sampling technique. All four dental practitioners had provided dental services to patients from the communities sampled and included three dentists and one government dental therapist. One focus group consisted of allied health care providers including: a nurse unit manager, a child health nurse and a women's health nurse. The other focus group consisted of three Indigenous Health Care Workers.

Table 4.4: Characteristics of participants in Case Study 2 (n=24)

Characteristics	Number of participants (%)
Sex	
Female	14 (58%)
Male	10 (42%)
Age groups	
18-30	6 (25%)
31-40	9 (37%)

41-50	5 (21%)
Over 50	4 (17%)
Profession	
Child Health Nurse	1 (4%)
Director of Nursing	4 (16%)
Nurse Unit manager	1 (4%)
Women's Health Nurse	1 (4%)
General Medical Practitioner	4 (16%)
Pharmacist	3 (13%)
Practice manager	2 (13%)
Mental health nurse	1 (4%)
Indigenous health workers	3 (13%)
Dentist	3 (13%)
Dental therapist	1 (4%)
Years in current practice	
< 1 month	1 (5%)
>1 month to <12 months	6 (25%)
>1year to 5 years	11 (45%)
>5 years	6 (25%)

4.2.4 Themes and subthemes

Three major themes emerged from the interview data and included the challenges faced to effective oral health care provision and access, communication and referral pathways, and strategies to address the challenges faced by patients in the three rural and remote communities. Subthemes were grouped within each of these themes and are illustrated in Table 4.5.

Table 4.5: Common Themes and Subthemes for Case Study 2

Themes	**Subthemes (number of responses)**
Challenges to effective Oral Health Care Provision and Access	• Physical and Psycho-social Effects on People's Lives (30) • Rural Dental workforce shortages (20) • Oral Health Advice (19) • Oral Health Problems Presentations (18) • Confidence in providing advice (18)

Communication and referral pathways	• Communication between primary and dental care teams (29) • Referral pathways (13)
Interest in Teledentistry	• Intraoral cameras/teledentistry (11) • Teleconferencing (6)
Strategies to improve oral health care service and provision	• Other service provision types (24) • Oral Health promotion (24) • Education and training for the NDRPCN (22) • Increasing dental workforce (18) • Increasing oral health funding (14)

4.2.4.1 *Challenges to Effective Oral Health Care Service and Provision.*

Many challenges and barriers to oral health care provision and access, are reported in the second case study of this research project. This case study differed from the first one in that data in relation to the impacts that poor access to timely oral health care had on the lives in residents of the four communities is included. The physical and psycho-social effects on people's lives are the most common challenges reported by participants in this second case study (30). Dental workforce shortages of both dentists and other oral health care providers are again a major concern (20). Further challenges are explored in relation to the types of oral health care advice that the non-dental primary care network offer in response to commonly presenting oral health problems (19). The levels of confidence felt by the primary health network in responding to these oral health presentations (18) are again examined in this second group of communities.

4.2.4.1.1 *Physical and Psycho-Social Effects on People's Lives of Poor Access to Timely Oral Health Care*

People in rural and remote areas who cannot access timely oral health care suffer many hardships, both physical and emotional. Participants from this second Queensland region were asked similar questions to those in the first case study regarding those physical challenges, however an additional line of questioning was added for this second case study relating to the emotional difficulties faced in relation to poor access to oral health care services. The responses to the psycho-social issues identified were categorised into seven subthemes. These included personal hardships associated with: the costs of dental treatment (9), the large travel distances to access treatment (8), the time needed off work to access treatment (5), the development of ambivalence towards the importance of good oral health (3), the mental health issues associated with chronic pain and an unsightly smile (2), the of lack of continuity of care (2) and, the fear of dental treatment itself (2).

Patients on low incomes, the "working poor", were reported as avoiding accessing oral health care due to the associated inhibitive costs (National Advisory Council on Dental Health, 2012). The cost of private oral health care was perceived by the participants to be higher in this rural and remote region than in capital cities.

> *The private dentist out here is so expensive that I still pay less if I go to my dentist in a capital city than out here. It is shocking the price difference for the same thing. (Child Health Nurse 2)*

Participants thought that those low-income earners who are not eligible for Health Care Cards were disadvantaged in being unable to access dental care due to cost.

> *It's a real cost issue because to use the dental services you need to have a Health Care Card and lot of our people are working but they are low income earning. None of us health care workers qualify for free dental. There are a lot of people on low income who don't qualify for a Health Care Card. The hospital system works well and with a Health Care Card the treatment is great but if you don't have that card! (Indigenous Health Care Worker 4)*

Participants also thought that residents on low incomes could not afford regular dental appointments and consequently often waited until the oral health problem was severe before seeking treatment.

> *Low income earners are the most disadvantaged and highly at risk. They leave it till it is a major problem because they can't afford to go every 6 months for check–ups. (Indigenous Health Care Worker 1)*

4.2.4.1.2 *Large distances to travel*

The time required to travel to visit the dentist created a major barrier to accessing oral health care by patients. Patients who possessed Health Care Cards could access oral health treatment via the government dental clinic, but still needed to travel long distances to access this care.

Many low socioeconomic patients did not own a car and required assistance to make the trip. Some participants reported that these people were forced to rely on a kind health care worker or friend to drive them to dental appointments.

> *They can't afford treatment and can't get there. Distance is the biggest thing and they don't mind travelling because that is what they do in the bush but only if they have transport available. (Mental Health Nurse)*

> *The other day I had a patient with big dental problems and other health issues, so I took her up to the hospital myself because she had no transport and that is not part of my job. (Indigenous Health Care Worker 4)*

Dental patients often had dependent children who couldn't be left unattended and primary care providers reported that these children sometimes needed to travel and stay with their parents overnight in the larger regional centre where the dental practitioner practiced. This all added to the expenses associated with dental appointments.

> *Transportation is a big thing. If they need to go to the dentist that is all day to get there and back so they often need to stay overnight which is difficult to do if they have families and young children that need them. (Women's Health Nurse)*

4.2.4.1.3 *Time off work*

Some participants reported that people were often forced to combine taking holidays with dental appointments. This impacted on their relaxation time during holidays when people were forced to attend health care appointments.

> *We don't book holidays to go on holidays out here. We book holidays to go to doctors, dentists, optometrists, and all that. It is not relaxing having holidays when you live in the bush. (Women's Health Nurse)*

> *I don't think many people out here have regular dental check-ups unless you travel away, and preventative treatments are essential to stem the oral health issues. There are a whole group of people out here who will have a dentist in a capital city and they will see the dentist when they take their kids to school or go on holiday or whatever. (Nurse Unit Manager 1)*

Several participants also reported that some residents were often unable to attend regular preventative dental appointments due to inconvenient dentist arrival times. Residents were unable to get away from work commitments that may be weather or stock related.

> *It might be mustering or bad weather conditions or something where the patient can't drop everything and come in because it suits the dentist visit time. (Mental Health Nurse)*

Health care providers themselves were often unable to attend regular dental appointments due to simultaneous work hours as the dental practitioners, and the lack of after-hours dental service provision.

Need an after-hours service as I can't get to the dentist myself as I need to work and can't just shut the door to go to an appointment. (Pharmacist 7)

No after-hours dentist, not on weekends or after dark. (Indigenous Health Care Worker 4)

4.2.4.1.4 *Ambivalence towards dental care*

Participants were concerned that the importance of good oral health maintenance was not understood by many of the residents in their communities and that people had no understanding of the connections between oral and systemic health. They thought that the consequence of this was ambivalence by patients in prioritising dental appointments.

The problem is we have a lack of oral health awareness here. (Practice Manager 2)

The problem is a lot of parents think that if the baby teeth rot it is ok because they still have permanent ones to come through later anyway. But the problem of education has not been addressed and bad habits are already formed. (Child Health Nurse 2)

There is certainly a lack of knowledge in the community and not just in the Indigenous community about dental care and health. (Indigenous Health Care Worker 4)

4.2.4.1.5 *Mental Health*

The impact of poor oral health on people's lives was reported to be often substantial, with the physical appearance of discoloured, broken or missing teeth contributing to low self-esteem for many people in remote Queensland communities. Coupled with the fear of dental treatment and anxiety about costs in relation to time off work, travel and dental procedural costs, participants said that many patients appeared to suffered severe psychological issues.

People get depressed when they have pain and tooth pain is bad. It looks bad and it feels bad and they get depressed. Pain has a secondary effect on mental health. They can't afford treatment and can't get there anyway. They don't mind travelling because that is what they do in the bush but only if they have transport. They pull out their own teeth in the bush. (Mental Health Nurse)

We have a lot of mental health issues due to bad teeth. People don't smile, and they get depressed from tooth ache. You got to remember that Indigenous people don't have much money and are on a low income. (Indigenous Health Care Worker 3)

4.2.4.1.6 *Continuity of care concerns*

The lack of regular, reliable service provision and lack of choice of dental care provider meant that many patients appeared to choose to seek regular care from the same dental practitioner that they had seen for many years in the capital cities.

> *For a long time, there was no private dental service in town and so we all got used to going to the big centres for treatment and now we have one in town, but he is so much more expensive than the one in Brisbane that we still travel away to get our dental work done. I know a lot of people who wouldn't touch the public dental system out here or the private one for that matter either. You get used to the same dentist and there is no continuity out here if you want proper, regular dental care. We worry about the cost and the reliability of ongoing care. Better to stick with someone who has your records and knows your history. You get better patient care. There are a whole group of people out here who will have a dentist in the capital cities and they will see the dentist when they take their kids to school or go on holiday. (Nurse Unit Manager 1)*

> *It would be wonderful if the patients could go to a dentist of their choice not just whoever happens to be around. (Director of Nursing 5)*

4.2.4.1.7 *Fear*

Fear of dental procedures was reported as a barrier to accessing oral health care for some of their residents.

> *They are also scared and won't go for this reason too. (General Medical Practice Manager 6)*

The long waiting times on government dental lists and the lack of a consistent school dental service had meant that many children required multiple dental extractions and extensive dental procedural work, which increased fear levels.

> *My niece has gone to the dentist for the first time in grade 2 because she has been waiting for the dentist to come to school. She had 5 teeth removed because it has been that long waiting and mum just couldn't afford it. The kids in schools need to be seen a lot more often than they are otherwise they are getting to the point where they are getting 5 teeth pulled. That terrorises them and when they are older, they won't go back. Fear is a major thing against dentistry also. (Indigenous Health Care Worker 4)*

4.2.4.1.8 *Rural Dental Workforce Shortages*

Participants from this second case study reported frustrations with the lack of a consistent, reliable dental service to the three communities examined.

> *We need a regular service so that people don't have to wait so long for treatment until it gets to the point of no return. We could then get people in more regularly for routine preventative treatments. You would be lucky to find a person in many outreach centres who has a good set of teeth. (Women's Health Nurse)*
>
> *A van coming once or twice a year is not "cutting the mustard". (General Medical Practitioner 17)*

The majority of participants of this Queensland region reported shortages in the dental workforce. These participants recognised that the entire rural dental workforce was in short supply. They described the dental workforce as consisting of not just of dental practitioners, but also of dental auxiliaries who augment the team including dental therapists/hygienists, dental technicians and dental assistants.

Dental Practitioners

Government dental practitioners were not permitted to treat private patients in this region, consequently if a patient did not possess a Health Care Card, they were not eligible for treatment at a hospital dental clinic. Participants recognised that a large proportion of the residents from their communities were unable to access timely oral health care due to the workforce shortages of private dental practitioners.

> *Give us some service and get the dentist to visit more often. We need private dentists visiting not just public. (Pharmacist 7)*
>
> *Get more dentists in the region. It is illogical that we have so few dentists out here. We have only one private dentist and if you have no private dental insurance then you can't see him. (Women's Health Nurse)*
>
> *We say to our people you have to get something done about your teeth, but they can't (because there is no dentist) and there is very little that a doctor can actually do about their teeth. (Indigenous Health Care Worker 4)*

Other oral health care providers

Participants understood that other oral health care providers were an important part of the dental team. Dental practitioners require chair side assistance to perform clinical duties, and it

was recognised by participants that dental technicians and therapists played an important supportive role in the provision of complete oral health care.

> *When people say, "we need more dentists" they really mean we need the whole team and the infrastructure to support it all. It is very hard to get dental assistants. We have three and are training up another dental assistant now. Getting a team is hard. We need dentists, dental therapists, and dental assistants. We need 2-3 dentists for the region. If we are unable to get 3 dentists, then we need 2 dentists and an additional oral health therapist and then we will need 5 dental assistants. (General Medical Practitioner 19)*

Other types of oral health care providers were believed to be important because they would allow the dentist more 'chairside time" to do active clinical dental treatments. Participants recognised the value of dental auxiliaries in providing oral health education, preventative treatments, and the construction of dentures.

> *A dental therapist or hygienist would be great coming through as they could screen the patients and then the dentist would only need to do the important things and not waste their time in check-ups and stuff. (General Medical Practitioner 17)*

> *We need dental technicians also. We had "Denture Adventure". A mobile dental technician for a while. They were good and made dentures for people. We need not just the dentists, it is the whole scope of dental workforce. We need dental therapists regularly giving a preventative bent then we will have a preventative practice and the dentists can do the fixing up stuff but with more prevention then maybe there won't be so much to fix. (Nurse Unit Manager 1)*

4.2.4.1.9 *Oral Health Advice*

The types of oral health care advice commonly given by 19 non-dental primary care providers when presented with oral health issues in the absence of an oral health care provider, included: referral to a dental practitioner (19), the provision of pain relief (14) and antibiotics (11), referral to medical practitioners (8), referral to an alternative oral health care provider (6), transporting the patient to the dentist (6), providing oral hygiene advice (6), admitting the patient to hospital with intravenous antibiotics (3), referral to the pharmacist for over the counter medications (2), giving a dental anaesthetic injection (2), consulting the Clinical Care Manual available in hospitals for information (2), placing a temporary restoration (1) and irrigating a dry socket (1). Some participants responded in multiple ways to the oral health issue that presented to them.

Referral to a dental practitioner: The most common advice given to patients with an oral health issue by the non-dental rural primary care network participants was to see a dentist and then they were given a prescription for antibiotics and pain relievers.

> *Ring the dentist to try and get the patient in. (Mental Health Nurse)*
>
> *I suggest client sees a dentist or other dental practitioner, see a doctor and I provide short-term pain relief. I have a look in their mouth and try and work out what the problem is and if I can l do anything about it. (Pharmacist 9)*

Provision of pain relief: Participants often felt that the most effective treatment option they could provide was to give analgesics to offer short term pain relief.

> *Suggest patient sees a dentist or a doctor and provide short-term pain relief. (Pharmacist 7)*
>
> *Suggest client sees a dentist or other dental practitioner, see a doctor and I provide short-term pain relief. I have a look in their mouth and try and work out what the problem is and if I can l do anything about it. (Pharmacist 8)*
>
> *You can't give them much advice if the hospital is closed and that. Kids under nine with a tooth ache often need Panadol or something. (Indigenous Health Care Worker 4)*

Provision of Antibiotics: Despite the understanding of the problems associated with the over prescription of antibiotics and antibiotic resistance issues, most participants described their second most common treatment option as the administration of oral antibiotics.

> *Suggest patient sees a dentist, provide prescriptions for antibiotics and provide short-term pain relief. (General Medical Practitioner 18)*
>
> *I provide prescriptions for antibiotics and provide short-term pain relief and suggest patient sees a dentist. (Director of Nursing 4)*

Referral to a general medical practitioner: Some members of the rural primary care network recognised that General Medical Practitioners may have some experience with dental emergencies and could provide dental anaesthetics as a short-term solution until dental care can be organised. These participants referred dental emergency patients to these Medical Practitioners.

> *I suggest the client sees a dentist and provide prescriptions for antibiotics and short-term pain relief, IV antibiotics and sometimes a dental block injection. (General Medical Practitioner 16)*

Referral to an alternative oral health care provider: In the absence of a dentist, some participants said that they suggested patients consult other dental practitioners such as dental therapists.

> *I suggest client sees a dentist or other dental practitioner like the school dental therapist. (Indigenous Health Care Worker 4)*
>
> *Suggest client sees a dentist, suggest client sees other dental practitioners and give oral hygiene advice. (Mental Health Nurse)*
>
> *Suggest patient sees a dentist or other dental practitioners, provide prescriptions for antibiotics and provide short-term pain relief. (Nurse Unit Manager 1)*
>
> *I suggest the client sees other dental practitioners. The dental therapist says the number of people that don't turn up to appointments is huge. So, it is better to give the parents the mobile number they can make contact themselves to book the kids in, so we just give the parents the phone number of the dental therapist. (Child Care Nurse 2)*

Transport patient to dental practitioner: Occasionally the participants personally transported the patient to a dental appointment or a hospital in the absence of a dental practitioner. Other ways to transport patients with financial restraints to oral health care practitioners have included utilising HAC (Home and Community Care), Anglicare and other charitable association transportation services, and some local city councils provided free transportations for some residents.

> *I suggest a client sees a dentist. If they have really serious dental problems and they have co-morbidity issues, then we can sometimes do something like take them to the hospital. (Indigenous Health Care Worker 4)*

Oral Hygiene Advice: Six participants from the primary care network responded to dental presentations by offering oral health advice such as diet and oral hygiene instruction.

> *Ask them questions such as "How long since you have seen a dentist?" "Where did you see the dentist?" I ask them questions about their diet, brushing, education. I find out when the dentist is coming and if not coming soon then when can I get an appointment for the patient. I follow up 6-8 weeks later with the patient to see if they have been sorted out. There is no feedback from the dentist. (Woman's Health Nurse)*
>
> *I suggest client sees a dentist or another dental auxiliary practitioner and I give oral hygiene advice. (Mental Health Nurse)*

Hospitalisation by General Medical Practitioners with intravenous antibiotics: It was reported that on some occasions, a dental issue went untreated for too long a period and the General Medical Practitioners had no alternative other than to hospitalise the patient and use intravenous antibiotics.

> *Dental problems become medical problems if not treated and we need to admit them to hospitals. (General Medical Practitioner 18)*

> *Sometimes need to admit them to Emergency Department and they are given IV antibiotics so I either send to the doctor or the dentist. (Woman's Health Nurse)*

However, the participants reported that occasionally patients have been unnecessarily hospitalised for dental conditions, due to lack understanding of dental conditions by General Medical Practitioners. For example, a participant explained that, as a consequence of patient non-compliance with dental practitioner instructions, a patient was inappropriately hospitalised.

> *The doctors look at dental issues and think they know what to do and that is the biggest issue. For example, I had to go down to the ward the other day and there was a patient there that they had admitted with a dental problem. There on the bed was this patient with an IV line in and she had a loose bottom tooth from periodontal disease! When I asked this patient a few more questions about it she said she had seen the private dentist a month ago, and he had said she needed to see a periodontist. She had not bothered to make that appointment. I told her to "make a decision" to either have the tooth out or see a periodontist but the doctors just discharged her the next day with oral antibiotics and she will probably be back for the same thing in hospital next month again. (Dental Therapist).*

Advice from the pharmacist: The pharmacist was often the most easily accessible health care professional in some communities and consequently were sometimes approached by residents from the communities for emergency oral health care advice and pain relief.

> *I give oral hygiene advice and I tell them to see a doctor or a pharmacist. You can't give them much advice if the hospital is closed and that. Kids under nine with a tooth ache often need Panadol or something. I take them to the chemist if it is not closed or to the doctor or dentist. (Indigenous Health Care Worker 4)*

Administration of dental local anaesthetic: Two participants reported that patients were sometimes referred to some General Medical Practitioners who had experience in the administration of dental local anaesthesia, for pain relief.

> *I refer them to the local General Medical Practitioner and a couple of them will give local anaesthetic blocks, then I let them know their options with the local private dentist or the hospital one. Sometimes they already have an appointment made so we organise for them to get antibiotics until their appointment turn comes around. (Nurse Unit Manager 1)*

> *Suggest the client sees a dentist and provide prescriptions for antibiotics and short-term pain relief, IV antibiotics and sometimes a dental block injection. (General Medical Practitioner 16)*

Emergency dental treatment by other members of the primary care network: Other rural primary care providers sometimes dealt with dental emergencies in the absence of dental and medical practitioners and they reported reading the dental chapter in the Clinical Care Manual available in all hospital and government medical facilities.

> *We consult the Clinical Care Manual all the time and do the treatment as directed in the book. (Director of Nursing 5)*

Provide temporary restoration material: One pharmacist reported stocking temporary dental restoration materials in the pharmacy for residents with broken fillings in the community.

> *Suggest client sees a dentist or other dental practitioner, suggest the client sees a doctor for a script provide short-term pain relief or antibiotics. I. provide short-term pain relief and a temporary filling material. (Pharmacist 9)*

Irrigate a dry socket: One medical Practice Manager described the experience of treating a dry socket.

> *I suggest the patient sees a dentist, I provide prescriptions for antibiotics and I provide short-term pain relief. I sometimes treat dry sockets by irrigating with local and referring to the dentist if possible. Follow the Clinical Care Manual treatment procedures. (Medical Practice Manager 6)*

4.2.4.1.10 *Oral Health Problem Presentations*

Participants reported variations in nature and frequency of oral health presentations to the non-dental primary care network providers.

Types of oral health presentations

The different types of oral health presentations reported by participants from the non-dental rural primary care providers included: Toothache (14), Abscess (10), Gum disease (7), Broken

teeth (3), Trauma (3), Filling Scripts (3), Missing teeth (2), Dry Socket (1), and Broken Dentures (1). Some respondents experienced more than one of these presentations in some appointments.

Toothache was the most commonly reported oral health problem by the primary care network and encompassed oral health conditions such as abscesses, broken teeth, dry sockets, trauma, broken dentures and the need to have prescriptions filled.

> *People have ulcers, toothache, oral infections, sore mouth, and bleeding gums. (Indigenous Health Care Worker 4)*
>
> *Abscess, roaring pain from broken tooth or gingivitis, emergencies, poor gums, and dentitions. (General Medical Practitioner 18)*
>
> *Dry Socket (Practice Manager for private medical practice (General Medical Practice Manager 6)*

It was particularly noticed by participants that missing and discoloured front teeth were common occurrences in the bush.

> *They have missing teeth, abscesses, have pain and if you have your front teeth you are not part of the community. (Mental Health Nurse)*
>
> *Decay is the most common problem and all the kids' teeth look black. (Child Health Nurse 2)*

Frequency of presentations

The frequency of the presentation of patients to the primary care network as reported by participants is presented in Table 4.6. General medical private practices reported oral health presentations from 2-5 times a month. Pharmacists in this district reported dental presentations to their pharmacies as often as 1-10 times a week whilst hospital emergency departments showed 1-2 presentations a week. Other allied health workers such as Indigenous care workers, child care nurses, women's care community nurses, nurse unit managers, and mental health nurses reported presentations for oral health conditions as often as 5-6 a week.

> *I usually see at least one patient with toothache a week. Particularly the four-year old children. (Child Health Nurse 2)*
>
> *I see dental problems all the time, especially at night when the clinic and chemist is closed. You can't give them much advice if the hospital is closed. (Indigenous Health Care Worker 4)*

Table 4.6: Frequency of oral health presentation to non-dental care providers

Frequency of Oral Health Presentations to the Primary Care Networks in Case Study Two		
Community	**Practice Type**	**Frequency**
Town E	Private Medical Practice	5 per month
	Public Hospital	2 per week
	Pharmacy	2 per week
Town F	Private Medical Practice	Everyday
	Public Hospital	1 per week
	Pharmacy	1-2 per week
Town G	Private Medical Practice	1 per fortnight
	Public Hospital	1 per week
	Pharmacy	1-2 per week

4.2.4.1.11 *Confidence in providing advice*

The confidence of the non-dental rural primary care professionals interviewed in providing oral health advice often varied depending on personal experience and post-graduate education. Three participants said that they were very confident in providing oral health advice and six were confident, four participants were not confident and seven were very unconfident

About half of the primary health care providers interviewed felt confident to give advice about treatment options for dental conditions.

> *I am confident that I can offer the pain relief and generally clear the infection or send them to Emergency Department for IV antibiotics. (Child Health Nurse 2)*

The remaining non-dental primary health care providers were less confident and were frustrated by their inability to instigate effective actions other than offering temporary pain relief or antibiotics.

> *Identification of oral health issues isn't the problem, everybody identifies it right down to any level, and the problem is being able to instigate an effective action. Having the ability to do something about a patient with a dental problem is the biggest issue. (General Medical Practitioner 19)*

> *Sometimes I am not confident enough in providing oral care advice. (General Medical Practice Manager 6)*

4.2.4.2 *Communication and referral pathways*

Communication and two-way referral pathways between the rural primary care sector and oral health care practitioners in this second case study were examined. Examples of good and poor interprofessional communication were sought and the two-way referral mechanisms in the three communities were explored.

4.2.4.2.1 *Communication between primary health network and dental care teams*

Participants reported examples of both successful and unsuccessful professional communications between dental practitioners and the rural primary care network were examined in the next section. Sixteen participants demonstrated examples of poor interprofessional communication and 13 participants gave examples of instances where interprofessional communication was good.

Poor interprofessional communication

Many of the interviewed participants reported that there was a frequent lack of advance notification of the time of dental practitioner visits. This made it difficult for the primary care network to schedule patients to see the dental practitioner.

> *We need information as to when the dentist is coming. (Pharmacist 7)*

> *It is word of mouth as to when he is here, we find out he is in town because someone walks past his window and the sign is up. (General Medical Practice Manager 6)*

Some non-dental primary care participants reported that the visiting private dental practitioner put a notice in the surgery window when they arrived, and that this dental practitioner saw no issue with the informality of this notification of arrival procedure. The dental practitioner confirmed this and expressed no need to formally communicate with Medical Practitioners or members of the rural primary care network as he felt patients were responsible for their own dental referrals. The informality of this notification of arrival procedure was reported by the non-dental rural primary care network to be inefficient.

> *I put a sign up in the window telling them when I am coming back, and it is word of mouth with this stuff. It doesn't take long. You know someone walks past and tells someone else and before, you know, the phone starts ringing. I am always busy when I come here. My books are always full when I come here. (Private Dental Practitioner 5)*

The government dental practitioner made himself more readily contactable by medical practitioners, but he was rarely contacted. He believed that segregation existed between dental

and medical practitioners and explained that he believed dentists were taught more about medical problems than doctors were taught about teeth.

> *I tell the doctors they can call me, but they never have. I have told the doctors they can ring me 24 hrs a day anytime and I will come in. The dentists and doctors are a little bit segregated, if necessary, the doctors on the ward will contact me if there is a dental problem but most times, I have found that the doctors are busy worrying about the rest of the body than saying "open up your mouth and see if there is a problem there." I think dentists are taught more about medicine than doctors are taught about oral health. The doctors often tell me a tooth ache patient is on their way down from the hospital and they come down the hall to me. I never refer anyone back to them it is a one direction flow. (Government Dental Practitioner 4)*

The visiting dental practitioner also acknowledged siloed behaviour between the rural primary care network and dental practitioners.

> *Doctors and pharmacists never contact me, and I have no need ever to contact them either. If a patient is sick well, he goes to the doctor. I fix his teeth if he has a problem. I told the doctors here "Don't even look in the mouth, that's my job". Doctors don't know what to do and that is why they need me. I fax scripts to the pharmacist in town all the time, but I don't talk to the doctors ever, they know I am here. (Private Dental Practitioner 5)*

The resident private dental practitioner in the larger regional hub community had only rare experiences of the rural primary care network contacting him for advice on dental conditions during his 20 years in the region. He expressed frustration with this situation and acknowledged that better interprofessional communication could be beneficial.

> *Occasionally the nurses from outreach clinics might ring and say, "Look what do I do with this?" but it is rare. When I initially started here there were 3 doctors and I gave them my phone number and said ring me if you need me. You get the occasional phone call saying they have a patient in hospital, can you have a look at it, but I have also had a patient ring me and say, "Look I am in hospital and when I get out of hospital, I need to get this tooth out". I would think, well hang on a minute why didn't the doctor just ring me himself in the first place! The other point is that doctors were too busy saving lives a few years ago, and they don't see dentistry as important. People were tipping over due to lack of doctors, but it is different now because we have so many more medical staff out here. There can be no detriment to getting better communication between the professions. (Private Dental Practitioner 6)*

Good interprofessional communication

Conversely, only a few respondents from the primary care network reported good relationships between themselves and dental practitioners servicing their community. Some of these respondents acknowledged that they were new to the district and were unaware of the availability of oral health care services.

> *The dental assistant is lovely, and she gets the patient in to see the dentist. I have a good relationship with her. It is who you know. (Indigenous Health Care Worker 4)*

> *I have spoken to the bloke who is the hospital dentist. He is a nice young bloke. We have a private guy who comes here every 5 weeks from Brisbane for 3 days, I don't know how well he is? Otherwise the [larger regional hub] private guy is always there, and the hospital dentist is available, if the patient can get travel assistance to go to him. And we have the NGO Mobile Dental Service which was here earlier in the year and that is great. (Director of Nursing 5)*

The level of communication between the two professional groups was again dependant on the readiness of a trusted dental contact person within the community to offer triaging and advice. In these three communities, this contact person was the dental therapist who was a resident in the community for twenty years.

> *I talk to the doctors all the time and the pharmacists. The community need a contact person for their oral health questions and because I have been around for so long they ring me and trust me to know who to contact. I was talking to the community nurse just now and advised her to tell a parent to ring me about her kid for an appointment. We have a mobile phone that we carry around with us everywhere. The doctors will contact me all the time about normal every day stuff as well, not just children. I direct them where to go with their specific problems. It has only been this year that we have had the permanent government dentist here and so previously we have had no-one to refer patients to, so it was up to me to figure out what to do. I have had to basically direct traffic for the last 20 odd years. (Dental Therapist)*

> *I speak weekly to the dental receptionist about scripts. If a dentist would come visit the pharmacy, then we could stock the shelves with what he needs the patients to use and it would be great to get the dentist to come and introduce himself. (Pharmacist 8)*

At the time of interview, it was the first year that a permanent government dentist has been on site in the centrally located hub community, to offer treatment to those able to travel to the service. The new government dentist was still settling into the position within the fledgling

government-based dental structure but was gradually developing professional relationships in the community.

> *I have a reasonable relationship with the doctors, I can't say I have ever really met them, I see them sometimes if I am doing a General Anaesthetic and I say hello. I have a good relationship with the ones in [smaller centrally located hub community] because I live there, and I talk to the doctors all the time. This is good, and they tell me they know very little about teeth and they refer everything teeth-related to me, after all that is my job to know about teeth, not the doctors but I don't really know the ones here in [larger hub community] because I don't spend too much social time up here anyway. Town E doctors' ring me and sometimes also the pharmacist rings if there is a problem with a script. (Government Dental Practitioner 4)*

> *The dentist sends a letter in with the stuff he needs the patient to have and I buy it into the pharmacy for them. (Pharmacist 7)*

A private dental practitioner recognised the benefits to be gained by introducing a teaching facility to the region to facilitate better interprofessional relationships.

> *The chief executive Medical Director for the second Queensland region is turning this regional hub community into a learning centre and by attracting all these auxiliary health care providers like speech pathologists and pharmacists they all socialise together, and they might stay out here. If they can continue to build that professional community base, then the local professionals will welcome the new ones and relationships will develop. Often the established professionals don't want to form close relationships with the new ones because they know they won't stay and that social structure that is out here in the West solidifies. If you have a whole lot of new professionals come in at the one time, then they develop relationships which will then infiltrate into the social networks also. If you come in by yourself, it's hard but if you come in with a whole lot of people in the same boat it is better. That's why that teaching facility is so good. Then they have medical student mates who have poker nights and invite the other students and relationships develop. The work out here is great, but the social life can be very daunting. (Private Dental Practitioner 6)*

4.2.4.2.2 *Referral pathways*

Two-way referral pathways were examined within these three communities for efficacy. Members of the rural primary care network reported frustrations with the informal nature of the

referral processes with dental practitioners. Frustrations were reported when patients with dental issues were sent to dental practitioners and no feedback was received.

> *I refer the patient to the medical staff at the hospital or private practice and they organise a dental appointment. I don't know when the dentist is here, but I think he has a phone number that the patients can ring to find out when he is coming but I don't do this. (Pharmacist 8)*

> *I find out when the dentist is coming and if he's not coming soon then I ask when I can get an appointment for the patient. I follow up 6-8 weeks later with the patient to see if they have been sorted out. There is no feedback from the dentist. (Women's Health Nurse)*

> *We need an established referral process. (Mental Health Nurse)*

Oral health care providers however felt that the referral system was working well and often reported being unaware of any issues or problems with the informality of the referral processes.

> *I am there when they need me but there is nothing formal. A few months ago, a general medical practitioner from this district rang me and said he had a patient of mine with swelling and I said to send him down. There was a case a while back with a trauma case and I wasn't here for whatever reason and the doctor rang the orthodontist in Rockhampton and he talked the doctor through the splinting procedure. (Private Dental Practitioner 6)*

> *The community need a contact person for their oral health questions and because I have been around for so long they ring me and trust me to know who to contact [for them to refer to]. (Dental Therapist)*

4.2.4.3 *Interest in Teledentistry*

The interest of dental practitioners and the rural primary care network in the utilisation of intraoral cameras was also assessed. The interest from participants, in including dental practitioners, into treatment planning teleconferencing meetings with medical practitioners, was also examined.

4.2.4.3.1 *Intraoral cameras/teledentistry*

Participants interest in the utilisation of intraoral cameras was generally limited, with only three respondents showing some interest in the concept. Eight participants were unable to see any value in the use of intraoral cameras to enhance interprofessional communication, due to the cost of implementation and the lack of a reliable broad band internet band width. Medical practitioners felt they were ill-equipped to do anything other than to give prescriptions for antibiotics and pain killers. The remaining participants were unsure if this technology would be

of any benefit. Dental practitioners believed that the intraoral cameras would be more of a benefit for dentist-to-dentist communication as a mentoring tool rather than as an aid to interprofessional communication.

> *Not for old buggers like me. The young ones might like it. More of a benefit if it could be networked (mine isn't) as a mentoring tool to talk to the young dentist from when I am home. (Private Dental Practitioner 5)*

> *You can talk them through it. The simplest thing is a phone call. You can start with that and if you need other things then you can start to talk about intraoral cameras later on. You can gauge the doctor on the phone, he may not want to touch it, whereas the next doctor might say yes, I will give that a go. (Private Dental Practitioner 6)*

The financial cost to set up the systems were seen as an obstacle and the lack of a sufficient broadband width, and internet reliability in outback Queensland, were other major obstacles.

> *It's a financial problem as finances are limited and the band width is not strong enough in outlying areas. We need an ADSL link and sufficient band width for intraoral cameras and in (three outreach isolated communities in the district) there is "bugger all" band. (General Medical Practitioner 19)*

> *Interesting idea but I don't think enough patients would benefit from it and it would be too expensive to buy. (Pharmacist 8)*

> *Economically not a viable option. Maybe at the hospital but not in the pharmacy. (Pharmacist 7)*

A medical practitioner understood the benefits of the dental images from the intraoral cameras but explained that they would not alter treatment options.

> *It doesn't change the "bottom-line" as it is only a picture and how can that help. I still would only give antibiotics and pain relief .(General Medical Practitioner 16)*

Three participants saw the potential value of the intraoral camera technology for triaging dental emergency care. One participant already used a similar technological approach on a smaller scale by taking images using a smart phone and sending those images to other medical advisers for triage and advice.

> *Excellent idea. Make us a trial community. I use my smart phone regularly to do this and think it would be an excellent idea. Medico legal issues if I was talked through providing treatment for dry socket for instance? Video links ups would be great. (Medical Practice Manager 5)*

A private dental practitioner suggested a "one on one" conversation with the practitioner over the phone was the best solution to sharing knowledge re patient care. He expressed the thought that some General Medical Practitioners might be more confident to be talked through dental emergencies than others.

> *You can talk them through it. The simplest thing is a phone call. You can start with that and if you need other things then you can start to talk about intraoral cameras and teleconferencing later. You can gauge the willingness of the doctor on the phone, he may not want to touch it, whereas the next doctor might say yes, I will give that a go. (Private Dental Practitioner 6)*

Twelve participants were unsure if teledentistry and intraoral cameras would be of any benefit in their communities.

4.2.4.3.2 *Teleconferencing*

The introduction of dental consultations to the already established telehealth and tele-conferencing patient treatment plan meetings was explored, with five participants showing interest and seeing the possible benefits of including dentists. One participant was not interested and 18 were unsure of the benefits.

Five participants could see the benefit for oral health professionals being integrated into telehealth conferencing. Telehealth was already used for medical specialist consultations and the inclusion of dentistry into the allied health team was seen to be of importance. One participant recognised the need to include oral health care needs in chronic health care planning days.

> *Telehealth services are available for linking with other facilities via video-conference for patients. We do it all the time, so for dental stuff it would be good. In fact, we are having a Community Consultation Forum tomorrow with a slide show and part of the discussion will centre on the Dental Plan. Chronic care planning days happen here at the hospital often and we teleconference with oral health being on the agenda. (Director of Nursing 5)*

> *We use telehealth for cardiology, oncology, mental health so why not dentistry. That would work and is a great idea. (General Medical Practice Manager 6)*

4.2.4.4 *Strategies to improve oral health care service and provision*

When asked, participants from the three communities examined in this second case study suggested five main strategies to improve oral health for residents in their communities. The main strategies to improve oral health for residents included: exploring other oral health service provision types (24), promoting community oral health (24), further education and training for the primary care network

in basic emergency dental first aid (22), increasing the dental workforce (18) and, increasing oral health funding (14). Within these major themes were many subthemes which were grouped in order of significance per number of responses by participants.

4.2.4.4.1 *Other oral health service provision types*

Five oral health service provision models were suggested by participants and included: mobile dental units (21), transportation for the patient to the dentist (11), school dental services (8), the utilisation of dental students and new dental graduates (5) and, Indigenous specific services (3).

Mobile Dental Units/NGO Truck: The group of communities in the second study district had to travel large distances to access oral health care and it was suggested to establish mobile clinics that travel to remote communities.

> *A solution is to have cluster dentists. Have a central dentist who is in a mobile unit to visit three or four communities in the neighbouring areas. Cheaper than setting up surgeries that won't be profitable for dentists to run. Put government money into mobile units for dentists like the NGO Mobile Dental Van and make it free. (General Medical Practice Manager 5)*

At the time of data collection for this research project, the Executive Director of Health Services was in the process of establishing a mobile dental unit, the "*Drover*", to service outreach communities. *Drover* was to be operated by the two incoming government dentists (also new dental graduates) who would be beginning in the New Year and who would replace the existing new graduate who had been in the district one year. These dental practitioners would be required to obtain their truck licences and undertake 4WD driver safety courses, in the spirit of an adventure experience working in rural Queensland.

> *We aim to have a Dental Drover up and running so they can operate a mobile dental unit to outreach centres. The idea is that the new dental graduates will be confident, you know, secure enough clinically to provide this service and to know it is a great adventure. We will encourage them to get their truck licenses so that they can take the Drover out to outreach centres. We will need them to do 4WD courses because our biggest risk in this type of district is people killing themselves on the roads. They take a dentist and a dental assistant only out in the Drover, not a dental therapist. (General Medical Practitioner 19)*

A voluntary oral health care service from two Buddhist dentists were reported to have visited the region in past years and the positive impact on the community of this visit was described by one medical practitioner.

> *We had a couple of Buddhist dentists who came and treated everyone for free a couple of years back apparently. That was great. All they asked for was a donation, but people wouldn't donate so that's rough. (General Medical Practice Manager 6)*

A private mining company in Queensland have joined forces with the NGO provide a free travelling mobile dental service to all residents in outback rural Queensland. This service is free to all residents regardless of financial status. This free service has made a significant impact on oral health service provision in the Queensland outback regions that it has visited. The final case study will examine the effects that this mobile dental service has on oral health in four of the Queensland communities that it visits and will be reported separately in this results chapter.

Transporting the patient to the dentist: Transportation for the patients to the remotely located dental practitioner in satellite hub communities was observed to be a sensible alternative to the infrastructure difficulties associated with bringing dentists to very small, difficult to access remote locations.

> *A transport system to get the patients to the dentist would be good. Some towns have a Home and Community Care (HAC) bus that takes them to the dental appointments, but we don't think that would be very child-friendly. Somehow, we need to get the kids to the dentist. (Child Health Nurse 2)*

> *The Town F Hospital can provide financial assistance through the Patient Travel Subsidy Scheme to eligible patients who need to travel away to other health services for procedures and tests not available locally such as the dentist. The doctor can request this as a dental problem can quickly become a medical problem if untreated. (Director of Nursing 5)*

Some of the local councils, community services and charities had instigated solutions to this problem by providing funding for transportation from these remotely located communities to oral health care services.

> *The local council funds a car or bus to transport the patient to the dentist, and they also fund a driver and a care giver. It requires a Health Care Card but if patient requires other treatment e.g. x-rays not available in Town E then they go in for that and get dental done at the same time. (General Medical Practice Manager 5)*

> *I ring the dentist to try and get the patient in and get them on a Greyhound bus to a hospital dental clinic in the district and I give oral hygiene advice. I ring HAC (Home and Community Care) to organise transport to the dentist, if they can't afford the Greyhound bus, as this is the biggest problem. There is a bus if you have a Health Care Card and the*

> *local city council provides a car if you can't get on that. I try Anglicare and St Vincent de Paul for transport. (Mental Health Nurse)*

School Dental Service: The School Dental Service had been facing its own challenges at the time of interview, due to staffing issues and had not been operational for some time. The lack of communication with the primary health network about the operation, or lack thereof, of this service was a source of frustration for the community. The benefits of a fully functional school dental service were described by participants and the school dental service was recognised as an important strategy to improve oral health care provision for children in the community.

> *The kids in schools need to be seen a lot more often than they are otherwise they are getting to the point where they are getting 8 teeth pulled. (Indigenous Health Care Worker 4)*

> *School dental is a huge problem at the moment, and the lack of service is a major complaint that we are trying to address at the moment. (General Medical Practitioner 19)*

> *I don't know if we have a school dental therapist service in the town. I think it might come every 2 years, but I don't know. (Child Health Nurse 2)*

New dental graduates: The staffing of the government hospital dental clinic with recent dental graduates was the strategy utilised by the Chief Director of Medical Services for this second research district. The plan was to entice new graduates to rural practice and hopefully encourage the new graduates to stay long term in the district.

> *We are actively trying to recruit new graduates from James Cook University. One is here now but he will be leaving at the end of the year and we have two new graduates arriving next year. We aim to "Grow your Own" encourage young dentists to come out here and settle down to work rurally hopefully to have satisfying careers. (General Medical Practitioner 19)*

The private dental practitioner for the region recognised the sense to this plan and has been a mentor to new graduates.

> *You need a good graduate and the Executive Director Health Services for this region has the two government dentists there now and they are a bit sluggish being new graduates and that is normal because you don't want them to rush but I think they are keen to stay another year and hopefully stay a few more years. I have an unofficial mentoring role for these new graduates. Because there is such a saturation of dentists in all the major centres and with all the new graduates, we are now getting quality dentists coming to our area.*

> *They might "give it a go". If they don't mind it out here and get involved in the community, they find there is a real future out here. (Private Dental Practitioner 6)*

Other suggestions were to encourage a compulsory rural rotation through the government system on graduation and to encourage an education role in preventative dental care whilst they are still students on rural placements.

> *I have heard there is a massive surge of dentist numbers and so a compulsory rural rotation through the public system could work. Catch them in their final year and make them aware of rural practice as an option and offer mentors in capital cities. (General Medical Practitioner 16)*

> *Get dental students out here to do a preventative education role for oral health. (General Medical Practitioner 17)*

Indigenous-specific dental services: Indigenous oral health care services often have separate funding arrangements and schemes such as "Closing the Gap" to allow Indigenous peoples to access timely dental care.

> *We regularly screen Indigenous people and we need to train the Indigenous Health Care Workers to ask the right oral health care questions. For some of our Indigenous clients we will work in with Medicare Local whose role is about trying to find funds and has the ability to fast track through to the public dentist. The private dentist won't see them. They have funding via "closing the gap". They help clients to navigate through the system and book appointments and then someone often drives them to their appointments also. (Nurse Unit Manager 1)*

4.2.4.4.2 *Oral health promotion*

Oral health promotion in rural and remote communities has been suggested as a strategy to highlight the importance of good oral health. The participants from this second case study identified five major ways to increase the oral health awareness within their communities. It was suggested to address issues around healthy diets for good oral health (10), establishing water fluoridation in non-fluoridated communities (8), educating the communities as to the importance of preventative oral care (7), dental screening in medical appointments (7), and the issuing of free toothbrushes (6).

Diet: Diet education was reported to be of great importance as an oral health promotional activity. The reality in rural Queensland as described by participants, was that it is often cheaper

to buy unhealthy food products such as soft drinks in comparison to fresh milk which was defined by high transportation and storage costs.

> *I see little kids go to the shop in their lunch hour and buy a 2.5 litre bottle of coke and that rots their teeth. So, the schools should be taking much more direction and the parents too. People would rather buy coke because it is cheaper than milk. I got a little grandson named after me and I didn't watch too closely what his mother was feeding him, but he went under an operation the other day and he's only 9 and has been suffering with toothache for about 6 years now. All his teeth were fallen apart. Last time I seen him he had the biggest smile and I hate to see another kid go through that you know. We need to start saying to these people we are destroying these kids' teeth and the adults too. (Indigenous Health Care Worker 4)*

> *There is certainly a lack of knowledge in the community and not just the Indigenous community about dental care and health. Soft drinks, food and milk and sucking on drinks all day. When you walk around the supermarket and a bottle of soft drink is a fraction of the cost of a bottle of milk, they will buy the soft drink. Giving a baby a bottle of drink to keep it quiet is still a problem. We have a limited access to fresh fruit and vegetables; the variety and quality is not there but it is on the top end of the expense. (Indigenous Health Care Worker 1)*

Water Fluoridation: Community water fluoridation was understood by some members of the primary care networks to be an effective mechanism for improving community oral health. Fluoride was reported as existing naturally in many water supplies throughout rural and remote Queensland including in Town E.

> *Fluoride occurs naturally in water in Town E, so teeth are generally good, so put fluoride in water in other places. (General Medical Practice Manager 5)*

One Indigenous Health Care Worker described his experience as an elder in his previous community with water fluoridation. He explained how the fluoridation of tank water supplies might benefit the oral health of his people.

> *I looked out my window every day and saw the water tank and I thought "Why don't we put something in that to clean the teeth like fluoride" because that was successful in other Indigenous communities throughout Queensland. I'm not saying we should chuck it in the water here Town E 'cause it's gonna cost a few thousand dollars but it needs to be approved by the community. (Indigenous Health Care Worker 3)*

Preventative dental care: The provision of effective preventative dental care was identified as an essential first step to stopping the progression of dental disease. Dental check-ups and other preventative treatments were reported by participants to be often not accessed regularly by residents in their communities.

> *I don't think many people out here have regular dental check-ups unless you travel away, and preventative treatments are essential to stem the oral health issues. You need feedback from your dentist about extra flossing around a certain tooth and without this feedback there is no preventative care. This precipitates through into the kids then too I suppose. (Nurse Unit Manager 1)*

Factors contributing to this lack of access to preventative care access were identified by participants and strategies to improve this access were described such as, increasing the dental workforce, decreasing the prohibitive costs associated with preventative care and improving oral health education.

> *The dentist when he does visit is always booked out and you can't get in unless it is an emergency so there is no room for preventative care like a check-up. (General Medical Practice Manager 6)*

> *Low income earners are the most disadvantaged and highly at risk. They leave it till it is a major problem because they can't afford to go every 6 months for check-ups. They need to be able to see the dentist regularly for preventative care like they do the doctor. (Indigenous Health Care Worker 4)*

Dental screening in medical appointments: Dental screening in medical appointments has been suggested as an appropriate place to monitor oral health for residents in rural and remote communities and to promote the importance of oral health in relation to overall medical health.

> *We screen four-year old's and that is a great time to corner the parents as well and give them a bit of oral health education. If they have shocking teeth, then the kids usually will too. We do immunisations at 4 months and that is another great time to throw some oral health education at parents before it is too late. Prevention is the answer. Every 12 months we see the kids, so we should be able to do gum checks, bleeding gums, brushing checks then. The 45-49-year old's get medical checks and we should do oral health stuff then and then again at 75 plus years. (General Medical Practice Manager 6)*

> *At the general medical screening appointments, we need to ask the patients, oral health related questions. We regularly screen Indigenous people and we need to train the*

> *Indigenous Health Care Workers to ask the right oral health care questions. (Nurse Unit Manager 1)*

A health plan for the second Queensland region that included a dental plan was established in 2012 by the Chief Executive of the region. It was called Stage 3 "Including Oral Health Prevention Efforts for Good Dental Health" and involved integrating oral health education, screenings, and assessments into medical milestone appointments.

> *We have multidisciplinary team strategies including oral health education in discharge from hospital procedures. Indigenous medical check-ups include an oral health screening question and in July they started to look for cavities and gum diseases. When a mother gets discharged after having a baby that is the perfect time to bombard her with oral health education for her and the baby. (Director of Nursing 5)*

Free toothbrush provision: Many participants from this Queensland region suggested that an effective cost saving government incentive for oral health promotion would be the provision of free toothbrushes to rural and remote residents. The cost of toothbrushes was described as prohibitive and participants described the inability of many families in these communities to afford a toothbrush.

> *At the moment, we go through the schools when kids are in prep and we teach the kids brushing. For us the best thing is to give away stuff like free toothbrushes because otherwise chances are these kids will never own one. Out here in the bush a tooth brush can cost $8 or $9. That would be helpful too for the promotion of tooth brushing if they were given the equipment and shown how to use it. (Child Health Nurse 2)*

> *We need access to toothbrushes and toothpaste, not for everybody but we certainly should be able to access this if needed. We need to have a small stock available for those people who simply can't or won't spend the money on these hygiene products. (Indigenous Health Care Worker 4)*

4.2.4.4.3 *Education and Training for the non-dental rural primary care networks*

When interviewed almost all the participants from the primary health care network expressed an interest in upskilling their knowledge in emergency dentistry techniques. Many expressed their interest in practical workshops, dental online lectures, articles in newsletters and journal articles on oral health related topics.

> *Extra training in emergency dental treatments would be good. I learnt how to re-implant avulsed teeth when I trained in South Africa and I have drained dental abscesses and 22 years ago, I learnt to do dental blocks. (General Medical Practitioner 17)*
>
> *The visiting dentist gave a lecture when he was here on oral health emergency treatments and if you look on the ACRMIN website there is a basic dentistry for rural doctors and this gives education on toothache options and how to give local anaesthetics etc. (General Medical Practitioner 19)*

Some dental practitioners agreed that medical practitioners would benefit from extra training in effective basic emergency dental treatments, rather than just resorting to the prescription of antibiotics and analgesics.

> *I mean I don't see why a doctor can't pull a tooth out. There was a case a while back with a trauma case and I wasn't here for whatever reason and the doctor rang the orthodontist in Rockhampton and he talked the doctor through the splinting procedure. (Private Dental Practitioner 6)*

Most allied health care workers also expressed their interest in further education in preventative dental care around topics such as diet and oral hygiene instruction. In the absence of a dental practitioner these allied health care providers recognised the possibility of a role for themselves in education for patients regarding oral health, as an important aspect of overall medical health.

> *We get basic training in dental care such as good nutrition, no sugary drinks and tooth brushing but better oral health training for us would help to improve education to the people in our communities. But that only brings them so far. (Child Health Nurse 2)*
>
> *We have nothing in our KPI's about oral health. I mean we know that poor oral health contributes to heart and kidney disease which are both major problems for our people and bad teeth contributes. We say to our people you have to get something done about your teeth but they can't and but there is very little that a doctor can actually do about their teeth. If they turn up with an abscess, then they can give antibiotics or lance the abscess if it is the right type to treat this, but they can't fix the underlying problem. They need a dentist to do that. (Indigenous Health Care Worker 4)*
>
> *Indigenous health workers don't have much training so up skill them to better sort out the problems. (Mental Health Nurse)*

4.2.4.4.4 *Increasing the Dental workforce*

Increasing the dental workforce was seen by the majority of the participants as essential to allow the appropriate ratio of dental practitioners to population base to be established. The participants suggested strategies to attract and retain dental practitioners and dental auxiliaries. These strategies included offering financial incentives and good working environments, encouraging new dental graduates to do rural rotations and offering mentoring for these recent graduates.

Financial Incentives and good working environments

Strategies to increase the dental workforce were suggested and included offering financial incentives and good working environments.

> *Offer financial incentives for dentists to practice rurally and say it is great for family and to make friends, so make the infrastructure good. (General Medical Practitioner 16)*

Coming to a mutually beneficial arrangement between public sector employment and the utilisation of those resources for private dental practice, was suggested to encourage more dental practitioners to rural and remote practice. The Executive Director of Health Services explained the problems associated with this model of practice in relation to the separation of dental materials and equipment between the two practice types.

> *An interesting concept would be to look at the dentists working in both public and private practice. It would depend on what remuneration model you had in place as to how it works. There are a whole lot of complexities around the mix of standards such as what are public supplies verses private supplies and using public things for private profit and all those sorts of things. You might get people who start bending the system for individual gain. You could get someone that was working there for 3 days a week as a public dentist and 2 days a week as a private dentist. That would be the gradation in lifestyle and how they would want to do it. (General Medical Practitioner 19)*

The government dental practitioner described how a model of shared private and government practice would attract more dental practitioners to work in these remote areas.

> *It would be great to work in private practice part time and government practice for the other time. It would be difficult to work as a private dentist out of a government clinic as the high-end products necessary would be unaffordable for a government budget. I think that if dentists could work in an arrangement where they can do private and public dentistry out here then that would work because only to work in government practice is*

> *restrictive to dentists and they need to ability to practice the other type of dentistry also. Lots of dentists are attracted to the more advanced high-end cosmetic procedures and the use of all the fancier tools that you don't get the opportunity to use in public health. (Government Dental Practitioner 4)*

New Dental Graduates

The incentives to encourage new dental graduates to work in remote communities were described by participants. Incentives such as offering mentors, financial incentives and lifestyle factors were explored. One general medical practitioner suggested that if new graduates could be inspired to interact in rural communities and meet new people, they might meet their life partner and settle long term in the district.

> *The dentists have a mentor in [the regional hub community] who is a private dentist. We are actively trying to recruit new graduates from James Cook University. We have a new graduate dentist here now, but he will be leaving at the end of the year and we have two new graduates arriving next year. We aim to "Grow your Own" and encourage young dentists to come out here and settle down to work rurally hopefully to have satisfying careers. The solution is the four "M's" .... meet, marry, mortgage and multiply. (General Medical Practitioner 19)*

It was suggested that a compulsory rural rotation for new dental graduates might be an effective mechanism for increasing the rural dental workforce.

> *I have heard there is a massive surge of dentist numbers and so a compulsory rural rotation through the public system could work. Catch them in their final year and make them aware of rural practice as an option. Appeal to older people and couples. (General Medical Practitioner 16)*

Mentoring for new graduates was described by all of the dental practitioner participants as essential in encouraging them to stay and work in remote areas. It was recognised that dentistry was a difficult profession to practice in isolation from dental peers.

> *We need good mentors to talk to, for us young dentists. I am part of the VGDP [Voluntary Dental Graduate Year Program] which is a federally funded program, and, in each position, you are assigned a mentor and my mentor is the private dentist in the larger hub community, but you have also got the whole VGDP network which has online resources and can contact specialists. It is very isolated for a young graduate, so it would be better to come as a couple. I want to specialise and so it is difficult to stay out here for too long as I*

> *might lose my skill set as dentistry out here is very emergency orientated. (Government Dental Practitioner 4)*

An older, more experienced visiting dental practitioner believed that dentists such as himself had an important role to play in providing mentoring capacities for recent dental graduates due to their high levels of experience.

> *You need to get more old, retired blokes like me out here. We are busy, have the necessary skills and want to retire soon. You only need to come out a couple of days every 5 weeks or so and that seems to work well. We want to mentor the young dentists a bit and help them along. That's what I need…a young fella, new graduate, who I can mentor then he can take over from me when I retire in 2 years. I think I have one hooked from James Cook University. (Private Dental Practitioner 5)*

Increasing government funding for oral health

The successful implementation of many of the above suggested strategies was reliant on increased oral health funding for both public based and private based dental care. Schemes cited by participants as having been either successful or not included: The Voluntary Dental Graduate Year Program (VDGYP), Dental Relocation and Infrastructure Scheme (DRISS), Child Dental Benefits Scheme (CDBS) and the Queensland Voucher for public patients to see private dental practitioners. The premiums for dental health cover were considered by participants to be excessive when compared to the benefits received.

Voluntary Dental Graduate Year Program (VDGYP)

Federal Government funding was sought for the improvement of oral health care facilities in rural and remote communities via the employment of new graduates through the VDGYP which ceased at the end of 2015. This scheme enabled new graduate dental practitioners to be placed rurally with mentor access, continuing professional development opportunities and financial incentives.

> *When the new dental graduate dentist came as part of the VDYGP he came with an infrastructure grant. From this grant, I ordered three digital x-ray scanners. These were of great benefit to him because at least if he took an image, he could shoot it through to his mentors. (Dental Therapist)*

Dental Relocation Infrastructure Setup Scheme (DRISS)

Federal Government funding was also sought via the DRISS, which is a government initiative to offer dental practitioners substantial funding grants to establish new practices in rural Australia (Health Workforce Queensland, 2016). This scheme had benefits for rural and remote residents

where a dental practitioner does not already exist. However, a dental practitioner reported problems with this scheme in that established dental practitioners already in nearby regions often felt disadvantaged in that the surrounding population base was often not large enough to sustain another funded dental practitioner. Existing dental practitioners would like funding to improve their practices to offer better services, as they had already made the financial and emotional commitments to the region, rather than to encourage professional competition.

> *To my mind just seems to get people to come out of the woodwork. Grants to me I think just gets people who wouldn't normally even think of coming out here and they are just coming out here to grab money. It would be nice if they had a program where they could be working together with the people who were already established here. It would be nice if a bit of that money came our way to help improve our already existing practices. I am not saying to cut out the new people but we have had people out here recently who were thinking of setting up here in the larger regional hub community and I said to them "Look at the end of the day you can do whatever you want but I have an established practice and I have a full book but if you come and work here we are both going to have two and a half days only or whatever". I am quite happy to poke along out here by myself, but it is really hard to throw $200,000-$300,000 into improvements to my practice if I think that someone might set up for free next door. I mean why bother, I know having two dentists will be good for the community but it's not really that fair I don't think. (Private Dental Practitioner 6)*

Child Dental Benefits Schedule (CDBS)

Another recent government initiative enabling rural and remote children access dental care had been the CDBS (Australian Government, 2017). This offered children adequate funding to attend dental practitioners which helped low income earning families access otherwise unattainable dental care. This was described by one private dental practitioner as an effective mechanism to increase the number of patients accessing oral health care who otherwise might not have presented.

> *There are physically not enough people out here unless you changed things with some sort of subsidy scheme. That's where that Children's Benefit Scheme [CDBS] is ideal because it seems to be working out well. That brings a lot of kids out of the woodwork to come and see me. If the government could do some sort of subsidy for the people on salaries of $30,000-$60,000 per year that would help. (Private Dental Practitioner 6)*

Queensland Government dental voucher scheme

In November 2013, the Queensland Government instigated a government dental voucher scheme to give eligible public dental patients on a waiting list in Queensland the option to have procedures done by a private dentist in the absence of a government hospital dental practitioner (Queensland Government, 2013; The Department of Health, 2017). A dental therapist suggested that this was a successful method to allow more patients to access oral health care in the absence of enough government dental practitioners.

> *The vouchers are good, and I gave them out for patients to go to the private dentist in the larger regional hub community. That happened a lot when we had no dentists in the district and if there were emergencies then they were sent down to him to deal with. The voucher was for $250 for emergency treatment and that usually sorts them out. (Dental Therapist)*

Private Health Cover

One Indigenous health care provider observed that private health funds did not offer acceptable rebates to make it worth the cost of taking out private dental cover.

> *Dental care needs to come under Medicare, it needs to be medically funded. The private insurance people, when you look at the cost, it is not cost effective to take out private health insurance to cover the cost of your dental care. (Indigenous Health Care Worker 4)*

4.2.5 Summary

Case Study 2 of this research project examined the public oral health care delivery model for three communities in a second Queensland district. 20 primary health care providers and four oral health care providers were interviewed. The public dentist attached to a hospital in the hub community within the district was readily contactable by telephone to offer dental advice, but challenges were still reported in gaining timely oral health care. The thematic analysis uncovered four main themes within the collective data set. These were: the challenges to oral health, communication and referral pathways, strategies to improve oral health in the communities examined, and the interest in dental technologies to manage dental presentations. Participants from this second case study also described the challenges that people from the three communities experienced in accessing timely oral health care and again reported how residents presented to the primary care network with oral health problems. These presentations to the rural primary care providers were again often of an emergency nature because residents generally ignored the pain of dental caries until it became extreme. Oral health issues that commonly presented to the primary care networks in this second case study included: toothaches, abscesses, oral/gum infections, sore mouths, dental trauma and, broken dentures.

The most commonly cited challenges to accessing oral health concerned the physical and psycho-social effects on people's lives associated with the high costs of treatment, large travel distances to access care, time required off work to access care, ambivalence to the importance of regular oral health care, mental health issues associated with unsightly dental appearances, lack of continuity of care for those patients wishing to access regular services and the fear of those dental services themselves. Another commonly reported challenge to oral health care access and provision, was the generalised shortage of the rural dental workforce in remote locations which included shortages of dental practitioners and dental auxiliaries such as dental therapists, dental assistants, and dental technicians.

Communication and referral pathways were explored in this second case study. The effect of this public oral health care delivery model on interprofessional communications and the consequent patient outcomes were reported.

Strategies suggested by participants from this region to improve oral health included improving dental service provision, increasing oral health promotion, upskilling of the rural primary care network in dental emergency care, increasing the dental workforce and increasing dental funding.

In common with primary care providers from the first case study, the providers from this second region of Queensland also advised patients to see a dentist or a doctor, provided short-term pain relief, and provided prescriptions for oral antibiotics. Few members of the non-dental primary care network reported calling the dentist directly for advice, even though he was contactable 24/7. Medical practitioners in this case study also reported that they often lacked the proper training to deal with these emergencies and were sometimes not confident to give emergency dental care, consequently they used antibiotics and analgesia and advised patients to see a dentist. One general medical practitioner from this region had a small amount of experience with dental emergency care provision and had given a dental injection and lanced an abscess, but the doctors from this region preferred to offer analgesia or hospitalise patients with intravenous antibiotics. Participants from the primary care network in this second research region also showed considerable interest in furthering their knowledge of dental emergency situations and their management options. It was suggested that emergency dental education could take various forms such as online or short courses, newsletters, or journal articles.

Other suggestions by participants to improve service provision were to support the use of a mobile dental unit to be driven by the government dental practitioner from the hub community. Another mobile philanthropic dental service that visits these communities once a year for two weeks will be examined in detail in the Case Study 3. A transportation strategy, which was also suggested in the

first case study, involved the facilitation of transportation for patients with dental issues to centrally located oral health services.

The continuation of the school dental service which was also struggling due to workforce shortages, was a suggested strategy to benefit oral health for children in these three remote communities. Indigenous specific oral health care services had not visited the communities for several years and consequently Indigenous people accessed oral health care services via the public dental system. The possible utilisation of recent dental graduates or dental students to provide oral health services in rural and remote regions, as part of a compulsory rotation program, was explored. Support was also given by participants, for the continuation of Indigenous specific oral health services.

Increased oral health promotion, was again reported by participants as a strategy to increase the oral health awareness of residents in this second research region. Participants supported diet education for good oral health as well as water fluoridation, and the provision of free toothbrushes to those unable to afford them. Preventative oral health care was recognised as the mechanism to stop the cycle of dental caries and the introduction of dental screening into medical appointments, was suggested by some participants to raise oral health awareness in their communities.

The primary care network from the three communities in this second case study described increasing the dental workforce, utilising dentists and other oral health care providers, as an important strategy to increase service provision and improve oral health provision and access. Ways of attracting the dental workforce were examined and the model of shared private and government mixed practice was suggested as a sensible option to support dental practitioners in rural and remote communities, as well as the better utilisation of new dental graduates.

Finally, increasing oral health care funding was suggested as a mechanism to improve the oral health care provision in this second case study. The complications of allowing dental practitioners the rights to practice in both a government and a private capacity from government dental clinics were identified.

The interest in the use of intraoral cameras to enhance this interprofessional communication was again limited in this second group of communities due to the unreliable internet broad band capacity in this remote district of Queensland, however the understanding of the value of including dental consultations into existing telehealth consultations, such as those which occur with medical specialists in regional centres, was recognised as useful by most participants.

The next case study examines the service provision by an NGO philanthropic mobile dental service.

4.3 Results Case Study 3: NGO Mobile Dental Service (MDS).

> *"Oral health is one of the most consistently unmanaged health issues presented to the Flying Doctor clinicians. Often by the time the patient presents, their oral health is in the late stages of deterioration because rural and remote Queenslanders do not have the same access to oral health services as their metropolitan counterparts."(Royal Flying Doctor Service, 2015)*

A third model of oral health care provision that exists in Central Queensland is an alternative form of service for both public and private dental patients. This mobile dental service provides oral health care services to all people regardless of their socioeconomic status. This NGO mobile dental service (MDS) has been in operation since February 2013 and is jointly funded by an independently owned Queensland mining company, through a private foundation, with services delivered and funded by an NGO. Funding was donated via the NGO who was the recipient of a $1.1million donation from the Commonwealth Government via the Health and Hospitals fund and a $3million donation from the private Queensland mining company. This philanthropic mobile dental service (NGO MBD) is subject to continuing government funding, private donations, and the continuing generosity of the private mining company.

This third case study will examine this model of oral health care delivery and the impact it has on oral health in Queensland rural and remote communities. The private mining company became involved in the establishment of this free mobile dental service because of concerns from its largely rural-based staff about the difficulty of accessing oral health services (Q Coal Group, 2013). This service has expanded and now provides free dental treatment to more than 20 rural and remote Queensland towns that had limited access to regular dental care (Figure 4.3). Several of these communities have been visited on multiple occasions and this influenced the selection of the four communities for the third case study of this research project.

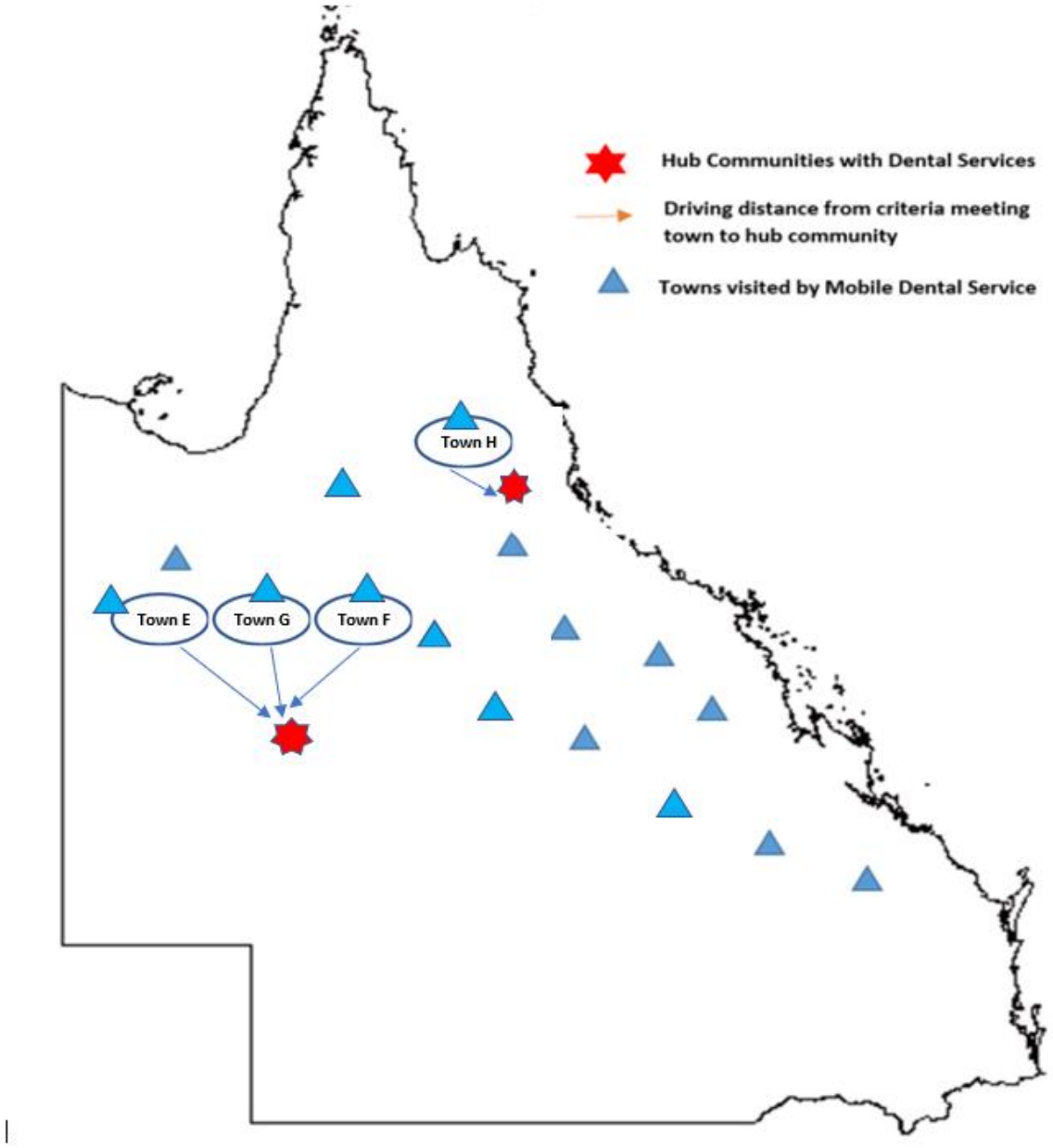

Figure 4.3: Case Study 3 - The communities serviced by the NGO MDS in 2015

The results from the first and second case studies were re-examined for any references to the NGO MDS. None of the communities from the first case study received visits from the service, however some participants reported instances where they were aware that residents from their communities had travelled enormous distances to access this philanthropic dental care. The three communities examined from the second case study received an annual, two-week visit from the NGO MDS and the data pertaining to these visits was carefully dissected from that second case study's data set for analysis in this third case study. A new community, Town H, from a different Queensland region, is

introduced in this third case study to ensure site triangulation and to offer a new perspective on the impacts of this philanthropic mobile dental service on this community.

This third case study explores the impact that the NGO MDS has on some of the fly-in fly-out private dentists and the nearby permanent private and government dental practitioners who have made a commitment to service rural and remote Queensland communities.

Of the four communities included in this third case study, three are directly visited by the NGO MDS (Towns E, F and H) and patients from Town G travel to the NGO MDS when it is situated in one of those other communities.

The same four research questions are applied to this case study. Further issues explored in relation to the mobile dental service examined in this case study include: discovering how the non-dental primary care providers feel about the service provision from the NGO MDS, how the existing dental personnel in the regions visited by the NGO MDS feel about the service provision from the NGO MDS; and how the NGO MDS viewed their own service provision.

4.3.1 Characteristics of oral health delivery services in Case Study 3.

Three of the communities already examined in the previous case study (Towns E, F, and G) have been re-examined for data relating specifically to the impact of the NGO MDS on interprofessional relationships with the rural primary care network, and a new rural community (Town H) has been added to provide robustness to the data pool. Table 3.2 in the previous methodology chapter details the characteristics of the selected communities that receive oral health service provision by the NGO MDS. Although the NGO MDS, did not include Town G on its direct route, patients from this community travelled to the MDS for treatment when it was in the area, consequently, this data obtained from previous interviews within this community was also included for study in this third case study.

The four communities selected for this third case study have access, albeit limited, to private and government dental practitioners. Distances for patients to drive to access these other oral health care services are extensive and the ability to negotiate the roads is weather dependant as many of the roads are unsealed. These four communities receive annual visits from the NGO MDS with the visits lasting for a maximum of two weeks.

The dental practitioners from the NGO MDS provide dental treatments ranging from acute care including fillings, simple root canal treatments, extractions to health promotion and preventative dental care. High-end procedures such as crowns, bridges, or cobalt- chrome dentures cannot be provided by this free dental service due to time restraints and the necessity for patient follow up.

The service provision structure is 8.00am- 6.00pm, Monday to Saturday for two weeks followed by one week off (to allow the mobile unit to travel the large distances to new communities and to allow staff changeovers). Consequently, treatment that cannot be completed in two weeks is not feasible (Royal Flying Doctors Service, 2016).

4.3.2 Characteristics of the participants

Eight new participants are interviewed for this third phase of the project, four dental and four non-dental participants. The characteristics of these eight new participants are detailed in Table 4.7. Data was re-examined from the first two case studies and those 59 non-dental and dental health care provider participants already interviewed in relation to their experiences of the NGO MDS. Few participants from the first case study had personal experience of the NGO MDS but some had heard of its existence. The participants from the second case study had some experience of the intermittent oral health care services offered from this philanthropically-funded MDS.

A new community (Town H) is included in this third case study. Four non-dental primary care participants who have experience in providing oral health advice and treatment to patients in Town H are interviewed by telephone and asked about their experiences with the NGO MDS. These new non-dental primary care provider participants include: One Director of Nursing, two Nurse Unit Managers and one pharmacist. Unfortunately, the General Medical Practitioner from Town H did not respond to repeated requests for interview and so was unable to be included in the results for this third case study.

Four dental personnel from the NGO MDS participated in phone interviews for pragmatic reasons. (two dental practitioners, one dental assistant and the Practice Manager for the NGO). The NGO stipulated the time and location for these phone interviews with the proviso for interview access being that the NGO Practice Manager also participated in a phone interview at a later date.

The same interview guide was used for both face to face and telephone interviews and the same interview techniques were employed to encourage participants to talk and therefore minimising the bias. The practice manger is included for interview as this person is instrumental in the operational procedures for the NGO MDS and provides dental promotion and advertising material and is largely involved in establishing interprofessional referral pathways. Approval from the General Manager of Health Services chair of the research committee for the NGO was sought via a committee meeting, for these interviews to take place. Permission was given to conduct these interviews provided that the Practice Manager was included in the interviews for this study.

As the research project evolved, further questions developed in relation to *intraprofessional* competition between the NGO Mobile Dental Service practitioners and already visiting government

dental practitioners and existing private fly-in fly-out or surrounding resident dental practitioners. Consequently, previous comments from eight dental participants in Case Studies 1and 2 are re-examined for relevance to this new *intraprofessional* competition issue and are included in this third case study.

Table 4.7: Characteristics of new participants in Case Study 3 (n=8)

Characteristics	Number of participants (n=8)
Sex	
Female	6 (75%)
Male	2 (25%)
Age groups	
18-30	2 (25%)
31-40	0
41-50	4 (50%)
Over 50	2 (25%)
Profession	
Director of Nursing 6	1 (12.5%)
Nurse Unit Manager 2 Nurse Unit Manager 3	2 (25%)
Pharmacist 10	1 (12.5%)
Dentist from NGO MDS 1 Dentist from NGO MDS 2	2 (25%)
Dental Assistant from NGO MDS	1 (12.5%)
Dental Practice Manager NGO MDS	1 (12.5%)
Years in current practice	
< 1 month	1 (12.5%)
>1 month to <12 months	0
>1year to 5 years	5 (62.5%)
>5 years	(25%)

4.3.3 Themes and subthemes

The recurring themes, such as challenges to effective inter-professionalism and strategies to improve this communication that surfaced within this new data were similar to those previously reported in Case Studies 1 and 2. However, within these common themes run the subthemes that relate specifically to the impact that the NGO MDS had on the oral health care provision in the communities serviced. The significant challenges faced to effective oral health care provision by the NGO MDS include funding continuation uncertainties, logistical issues for the NGO MDS relating to time constraints and road conditions that cause access difficulties, continuity of care issues for rural and remote patients and, professional competition with existing rural dental practitioners already servicing the communities.

The strategies to improve oral health care provision in the new community (Town H) were similar to those uncovered in the two previous case studies. This third case study however, specifically examined the strategies for improving the oral health care delivery by the NGO Mobile Dental Service. These strategies included the possibility of providing increased numbers of mobile dental units thereby increasing the overall dental workforce and providing a greater focus on preventative dental care. The themes and their associated subthemes are illustrated in Table 4.8 below.

Table 4.8: Themes and Subthemes for Case Study 3

Themes	Subthemes (number of responses)
Challenges to Effective Oral Health Care Provision by the NGO MDS	• Travel and cost (12) • Logistical issues (12) • Types of oral health presentations and limited available treatment options (11) • Competition with local dentists (10) • Dental workforce shortages rurally (7) • Funding uncertainty (4) • Exploitation of the NGO MDS (4)
Influence of visits by the NGO MDS on Rural Communities	• Patient compliance difficulties (3) • Time off work (2) • Mental Health (2) • Fear (1) • Continuity of care concerns (1)
Communication and Referral Pathways	• Interprofessional Communications (57) • Referral pathways (13) • Appointment booking and notification of NGO MDS arrival (7)

Interest in Teledentistry	• Intraoral cameras/teledentistry (8) • Teleconsultations (2)
Strategies to Improve Oral Health Care Provision by the NGO MDS	• Oral Health promotion (31) • Better service provision (23) • Increasing the NGO MDS workforce (9) • Upskilling non-dental primary health providers to provide adjunct oral health care (5)

4.3.3.1 *Challenges to effective oral health care provision by the NGO Mobile Dental Service.*

Challenges to effective oral health care provision in the new community studied in this third case study were similar to those found in communities in Case Studies 1 and 2. Challenges included: dental workforce shortages, physical and psycho-social challenges to patients, high costs of private dental care, large distances to access dental care, fear of dental treatment, poor interprofessional collaborations between dental and non-dental care providers and, lack of effective referral pathways. This section of the results chapter will focus on the challenges specific to the NGO MDS in the provision of effective oral health care. These challenges will be reported from the viewpoints of the three different groups: (i) non-dental primary care providers from the three case studies; (ii) dental participants from Case Studies 1 and 2 and; (iii) from the dental personnel on the NGO MDS itself.

The data collected relating to challenges that the NGO MDS faced was further organised using subthemes which reported: travel and cost issues for patients seeking oral health care advice and treatment from NGO MDS (12), logistical issues faced by the NGO MDS (12), the types of oral health problems and the limited treatment options provided by the dentists on the NGO MDS (11), the impact on people's lives of the NGO MDS (10), perceived professional competition with existing private local or fly-in fly-out dentists or government dentists (10), rural dental workforce shortages (7), funding uncertainties (4) and, exploitation of the NGO MDS (4).

Congruent with results from the first two studies, the difficulties associated with large travel distances, accessibility, and the cost associated with this travel have created significant barriers to accessing oral health care for patients in the new community, Town H. The NGO MDS attempted to address this issue of large travel distances by providing a mobile service.

4.3.3.1.1 *Large travel distances to access oral health care*

The NGO MDS travels to and operates from twenty centralised hub communities in rural and remote central Queensland. The service's arrival at the next hub town location is advertised in

advance of arrival and the truck is then parked in this hub community and the patients travel to the mobile dental service.

> *We try to pick a larger community that is centralised. Our advertising goes out to the surrounding communities and the locals know they can travel in to the truck. (Dental Practice Manager)*

Sometimes the local councils provided shuttle buses to these hub locations or patients car pool to them. This was a locally-based solution to the accessibility and cost of travel problem.

> *The NGO Mobile Dental Service doesn't come to this larger hub community but when it was in Town B, we had a busload of people that travelled there to be seen by them. (Nurse Unit Manager 1)*

> *Some of the councils put on a shuttle bus, but we have only had this in a couple of communities so otherwise it is just people bringing their cars in and driving themselves. I negotiate that shuttle bus with the council and it is usually in the smaller towns and sometimes it is the community RSL that we can tap into that. Sometimes if we go out to other outreach centres, the Indigenous community out there have students and we want to encourage them and they have their own little "People Mover" and so we will often block out a couple of hours so that they can bring people in from there as well. So, we negotiate all that. (Dental Practice Manager)*

Participants reported that people holidaying in Central Queensland who had dental emergencies while travelling sometimes accessed the NGO MDS. The large travel distances to access emergency dental care from this philanthropic mobile dental service were seen as a necessary part of life for many grey nomads (retirees who travel with their caravans and motor homes throughout Australia).

> *There are times when we will be in a particular area and a "grey nomad" will be passing through who has private health insurance or could afford to have dental treatment privately. We never turn them away. (Dental Assistant 2)*

4.3.3.1.2 *Cost of dental treatments*

According to some of the participants, the high cost of dental treatment was a significant barrier to accessing dental care. The concept of free dentistry enticed many rural and remote patients who otherwise might not have sought dental treatment to present to the NGO MDS.

> *Cost is a barrier, access is another one. One of the issues we face is that dentists are generally really too expensive. (Dental Practice Manager)*

> *We are working for an Australian icon, there is a lot of goodwill. They are always surprised to find that we do dental treatments for free. (Dental Practitioner 7)*

The "working poor" who cannot afford private health cover but are not eligible for a Health Care Card , are often the recipients most in need of the NGO MDS.

> *I know that a lot of Queensland Health clinics are a one tooth policy and strictly a Health Care Card or a pension card. A lot of the people that this service is designed for are just above that area where you earn too much or have too many assets to have one of those cards, but they don't earn enough because when you have to go to the private dentists out in rural areas or further West, the prices that they charge for treatment are exorbitant. (Dental Assistant 2)*

The NGO MDS also treats patients with private health cover. They ask for a small fee for service, but the private health cover rebate covers this "out of pocket" expense. These patients sometimes offer a donation which is given to the NGO.

> *We can quite often take $20 000-$30 000 a week from their private health funds. We never ask them if they have a Medicare card because it has no impact on what we do or whether we treat those patients or not. (Dental Practitioner 7)*

Residents have been known to travel large distances to access dental treatment from the NGO MDS, even though dental treatment was available in their own community.

> *The NGO Mobile Dental Service was interesting in that people paid as much in fuel to get there for free treatment as they would if they used the service available to them in their own town. (General Medical Practitioner 4)*

> *Town E patients are awful because they want free treatment only. When the dentists are free, they will visit but if have to pay then won't go. The waiting list is very long for truck, so some patients followed the truck to where it was not as busy and got treatment done. (Practice Manager 1)*

4.3.3.1.3 *Logistical issues*

Logistical issues surrounding the physical movement of the large 18-wheler semi-trailer truck sometimes posed challenges to the effective delivery of oral health care services by the NGO MDS in the remotest areas of Queensland. These logistical issues included: time constraints put on community stays (7), poor road conditions (2), telecommunication inadequacies (2) and dental supply delivery difficulties (1).

Time constraints: The NGO Mobile Dental Service has strict time limitations when visiting communities. Two weeks is the maximum stay available to enable coverage for the 20 communities in Central Queensland region. It was reported that time constraints mean that many people missed treatment and often followed the truck to the next location.

> *The NGO Mobile Dental Service was here in June and they were flat out. They parked in the hospital grounds for 2 weeks. They had one dentist on for one week and then he flew out and a different one and a different driver flew in for the second week. (General Medical Practice Manager 2)*

> *We are very time restrictive and much as we would welcome more referrals, the more that that increases we just have to watch our demand management, because we are generally booked out every location that we go to. Looking back on our patient numbers we would see across the two weeks we would see no less than 130 patients and up to 170. So, I suppose our time limitations are a barrier. We have a set amount of time. (Dental Practice Manager)*

The substantial distances between locations and the time constraints for staying in each community, often make it impossible for dental practitioners to complete complicated treatment plans and consequently dental treatment options are often compromised. The dentists who work in the NGO MDS expressed frustration in being unable to offer time-consuming dental procedures such as root canal treatments, crown and bridge work or dentures. Another source of professional frustration due to time constraints, was that they were unable to see all the patients that presented to service.

> *I have had dental graduates who for instance start root canals and because of time restraints, we must get the patient back to finish the treatment in the following location. It is not always possible because sometimes we jump from one location to another and it can be a few thousand kilometres away. I don't find it frustrating other than having to force the patient into a choice, either it's an extraction or they will have to go to the private dentist and pay $1000 or $2000 for a root canal treatment. (Dental Practitioner 7)*

Time constraints not only limited the treatment option choices, but they also impacted on patient access to the service. Country people's job availability is often weather dependant and if they are busy with farm duties, they are unable to attend dental appointments.

> *They say" I'm too busy, I've got stock to feed and cattle to do this with and I have to do this and that" and I say, "well we are only in your area for this amount of time and you really need to make time". A lot of the wives are really pushing them to come in because we are a*

> *lot closer to the properties and so our service has a really big impact on that sort of demographic. (Dental Assistant 2)*
>
> *A mobile unit would be great, but they only pick up the problem when the dentist is there, and this might not be a convenient time for the patient. It might be mustering or bad weather conditions or something where the patient can't drop everything and come in because it suits the dentist visit time. (Mental Health Nurse)*

Poor road conditions and amenities: Participants reported that road conditions needed to be of a high enough standard to enable the sensitive dental equipment on board the NGO Mobile Dental Service to remain undamaged in transit. Level ground is necessary to allow the equipment to operate properly. Internet access, mobile phone access and a solid three-phase power supply are all necessary as well as mobile phone access to enable communications and appointment booking. The truck has a satellite dish for emergency communications only in the absence of mobile phone coverage.

> *It is an 18-wheeler, and it has very sensitive equipment inside it, and it has an OPG machine for instance. Our delivery tray keeps cracking probably due to the resonance delivered to it inside the truck. Dust is a big issue as well. We want to stick to good roads as much as we can. But it's not just the roads. We need access to three phase-power also. We have a generator on board. We have 3G and our software backs up to base every hour. We need internet access if it is available. For example, in one community we were told there was 3G mobile phone coverage but there wasn't. We were told they had three-phase power and they didn't. So, when we got there, we only had a satellite dish and we couldn't get mobile phone reception. (Dental Practitioner 7)*
>
> *The NGO Mobile Dental Service can't come down the back roads because it is too rough. (General Medical Practitioner 4)*

The logistical issues such as lack of adequate phone reception has been known to cause problems with communication to the NGO MDS in some remote locations.

> *We did have only one complaint and that was from somebody who telephoned the 1800 number and couldn't get through. That was because we were in a community that didn't have coverage there and we were on Satellite phone out there. (Dental Practice Manager)*

Delivery of supplies: The delivery of supplies needed for the NGO Mobile Dental Service was reported to also pose a logistical challenge. The huge travel distances involved and the

remoteness of some of the communities sometimes meant that delivery delays can occur which created further time constraints for operative dental delivery.

> *It's not only the logistics of the truck but it's the stores also. Last year we had a major problem getting the stores out here. The delivery guy had quit, and I didn't know until I got out here. So, I had ordered my stores and when I got to the hospital they weren't there. I was lucky because the publican here said he would pick the stores up for us and bring them back here. (Dental Assistant 2)*

4.3.3.1.4 *Types of oral health problems, presentations and available treatment options*

The rural primary care network in the Town H also reported similar types of oral health problem presentations to those experienced from the primary care network participants in Case Studies 1 and 2 of this research project.

> *I would see 3-4 toothache patients a month. The problems are mainly ulcers, toothache/pain relief, broken/lost fillings, trauma, and teething. (Pharmacist 10 Town H)*

> *We see a lot of dental here and it is usually after hours. I have the admission sheet in front of me and 3 in one day on Friday. The patient came in at eleven o'clock at night and the doctor had to come in to see them. Yes, so going through it all I'd say four to five a week. (Director of Nursing 6 Town H)*

The pharmacist from Town H also described his understanding of the importance of preventative dental care and that the promotion and education of preventative oral health care was paramount to stopping the disease.

> *Encourage patients to have check-ups regularly and preventative treatments. (Pharmacist 10 Town H)*

Emergency dental care alleviates immediate, acute pain whilst comprehensive dental care also includes complex and time consuming dental procedures which include root canal therapies, crown and bridge procedures, dental implants, and the construction of removable dentures. Comments from dental personnel from the NGO Mobile Dental Service, private dental practitioners and the non-dental primary care providers relating to the volume of problem-based dental care provided by the NGO Mobile Dental Service compared to the amount of comprehensive and preventative care given were reported. Seven comments related to the large volumes of emergency dental care given and four comments reported the provision of preventative dental treatment.

The types of emergency dental presentations to the rural primary care network were often severe in nature and the presence of some form of dental care in the vicinity was helpful in emergency situations. A Director of Nursing explained that one in three medical emergencies were from dental origin at a recent outreach community event.

> *Well I have had some previous experience with this in my capacity as a nurse for the NGO. We were in an outreach community earlier this year for the races and of the three medical emergency fly outs that I had to organise, one of them was for dental. I was a flight nurse based in Townsville and was involved with the development of the NGO and mobile dental van development. So, the NGO Mobile Dental Service is a wonderful thing and we need more of this sort of service out in the bush. (Director of Nursing 5)*

The primary, emergency care of the dental patient was the focus for the NGO MDS. Return visits often resulted in dental caries progression to emergency status in those patients who did not pursue follow up appointments when the truck left. Due to time constraints, extractions were a common treatment modality compared to saving the tooth with root canal therapy.

> *Lots of fillings and extractions. It is just not feasible to do prosthetic work, so no dentures and no crowns or bridges. Also because of the short stays that we have, we don't really do a lot of endodontics either. We stress the importance of getting the root canal finished but we keep coming back and so a year later we take those teeth out, so it is not ideal. Compliance is an issue. So, we actually focus on the primary care for the patient. (Dental Practitioner 7)*

Professional dental experience was an important requirement for dental practitioners working in the NGO MDS. Dental extractions in the late stages of dental disease are often complicated and require expertise by dental practitioners.

> *You need quite a lot of expertise to manage that type and level of treatment and we definitely try to relieve the pain as soon as possible and we try and steer clear from detrimental effects, but we definitely also have to deal with the negative of extractions and surgical removals of teeth. I think that the main thing would be that in many cases the teeth are unsalvageable because we get the patient in such a late stage of dental disease because you can't turn the clock around, even if you have the capability of either treatment, it would not be a long-term solution. (Dental Practitioner 8)*

Participants reported long waiting lists to access treatment from the NGO MDS due to it non-discrimination towards private cover or Health Care Card-holding status. Participants had

observed patients having difficulty accessing preventive dental care such as check-ups because the patients with emergency dental problems were triaged with priority.

> *The NGO Mobile Dental Service was good for both health care card holder and private patients, but you couldn't get in for a check-up. It provided emergency treatments only. (Pharmacist 9)*

> *A lot of the people we see need that acute straight up care. (Dental Practitioner 8)*

Dental presentations to the NGO MDS were reported by dental personnel to be mainly for treatments of significant amounts of dental caries and emergency dental presentations. This proved to be overwhelming for dental practitioners and consequently careful appointment book planning helped to alleviate "burn-out" by the practitioners.

> *At one stage, it was very stressful, and I did load myself too much. Twenty-four filling was more-or-less the average. We didn't finish the list at all in one community, and you were forever thinking of those who didn't get help. So, what we do when we get to a new location, in 45 minutes I will do a check-up and do x-rays and if I diagnose, I get consent and I inject there and then and then I'll do a clean and 4,5 or 6 fillings all in that 45 minutes and then I'll do the next patient. We've been told by some locums who come on board the truck also that they don't know how we do it. (Dental Practitioner 7)*

> *A lot of the people we see need that acute straight up care. (Dental Practitioner 8)*

The emergency only treatments offered by the NGO MDS was criticized by one fly-in fly-out dentist who indicated that the limited treatment options available meant that rural and remote residents were disadvantaged by not having the comprehensive options that their city counterparts might be offered by private dental practitioners.

> *Rural people are not stupid, they want good quality dental care. They want options other than extractions given to them. The NGO Mobile Dental Service provided a service where they just want to pull the tooth out. Rural people don't want this. Rural and remote dentistry should not equal second-class dentistry! They want better dental options. People who have been to the truck have said to me they will never go back. They will wait for me to come back and so I can give them better, more complex dental options. It goes against all our training to just offer this basic stuff [dentistry consisting of emergency extractions] when there is better stuff available. (Private Dentist 2)*

For a patient to receive ongoing dental care, beyond the basic emergency care with the NGO MDS, it was necessary for the patient to follow the truck for long distances from town to town and fit in with their tight scheduling regimes. A dental assistant described a typical scenario;

> *We had a classic in Town F. He'd been to the Queensland Health dentist and he had one tooth removed, the 48 (lower left wisdom tooth), and didn't do any other work. He came to the door the next day and his face was swollen. So, we said come in and we took an OPG and the two teeth in front of the tooth taken out were also abscessed. He had massive amounts of decay through his entire mouth. We ended up getting him back about three times while we were in town F and he followed us to the next community to get further treatment because we couldn't get it all finished in Town F because of the extensive work that he needed. (Dental Assistant 2)*

Patients on Health Care Cards with lots of dental issues, were reported to often require multiple appointments with long waiting periods between each appointment. The NGO MDS offered multiple treatments in each appointment to maximise efficiency of care during the limited time spent in each community.

> *Queensland Health dentists have the one tooth one appointment rule. If a patient comes if for pain on the left side, they will treat that, and they have not done an x-ray or any type of check-up or preventative treatment. I am not trying to pay them out but because of this treatment policy they will never have the time to get to preventative care. These people will just go back onto the waiting list until the next issue. So, if they change their treatment model then they can spend more time on preventative care. (Dental Practice Manager)*

Dental personnel from the NGO MDS understood the necessity to stop the cycle of untreated decay leading to emergency interventions and the need to implement more preventative based treatment options.

> *The preventative stuff is key. If that was done to a professional enough standard then there would be no need for us to do such acute intervention. We want to move it more to preventative treatments and so we want to possibly increase those numbers with people just coming in for a check-up and so they are quicker procedures and we are not needing to do fillings and pull teeth out. (Dental Practice Manager)*

> *We do a lot of cleaning and scaling and polishing of teeth. We try to focus on the importance of giving the patient the information they need for the long term. We made a fantastic impact on one community because of what we did in those two weeks the year*

before. It has taken us three rotations to make inroads into the oral health of these patients. (Dental Practitioner 7)

4.3.3.1.5 *The impact on the health of rural and remote residents*

The combination of a government-funded hospital dental clinic care for patients with Health Care Cards and the repeat visits from the service offered by the NGO MDS was reported by most of the participants as having a significant impact on rural and remote oral health.

Especially this year, we have seen a lot more exams and check-ups, you know that yearly check-up that everyone should have. That is starting to take shape now and we are getting on top of that really acute phase. We thought we would be on top of Town H, but this year proved that we are not. Whether it is a change of population because the mines have all changed with more people coming and going. Queensland Health are doing a fair bit now regularly also. So, it is the working between the two services that seems to be helping. You can definitely see that the amount of acute and chronic dental problems is decreasing. (Dental Assistant 2)

Personnel from the NGO MDS reported that they have noticed a slight decrease in the volume and severity of the oral health presentations as they have reached the phase of multiple return visits to certain communities.

We are now at the "nerdy phase" and now that we have been into places multiple times, we are collecting data from visit two or three. Then we will compare it to visit one and that it how we will be able to see the number of extractions and the average number of fillings decreasing in those sites and we can also see a cost per patient decreasing. We have only done that data for the last three months and we have been looking at that and we are not quite comfortable yet in releasing that data until we have done a little bit longer in the data collection and then releasing that information, but the numbers are definitely at this stage heading in the right direction. We know of course that there can be a number of external factors that need to be considered but we think we are on the right track. (Dental Practice Manager)

4.3.3.1.6 *Competition with local dentists*

The longevity of the NGO MDS was questioned by some primary health care participants due to the uncertainty of the continuation of the funding for this service, which would lead to a lack of continuity of care. The fact that it draws patients away from the rurally place dental practitioners was also deemed to be an important issue by participants.

> *I don't know that the NGO Mobile Dental Service is really the solution out here. We don't know how long they will be coming for. They don't visit all the towns and people keep moving. People trucked from one town to go there because they got a free service, but then they didn't utilise the service that they had in their own town that you would have to pay for. There is no consistency and you need all your x-rays done again because there is nothing on file and you don't know if they will come back so I don't know if those drop-in services are all that helpful. They make for feel better in the short term, but I don't think that they help the community for the long term. (Nurse Unit Manager 1)*

Although the NGO MDS was careful to avoid communities that already have an established dental practitioner, the nearby resident dentists and the established fly-in fly-out dental practitioners often felt the impact of the free dental service in their districts. A private dental practitioner was concerned about the financial ramifications to his practice from the services delivered by the NGO MDS.

> *I don't like the idea of too many NGO mobile type dental services giving out free treatments to everyone because that will undermine my practice. At the moment, I am reasonably stable, but you don't want to get too many dentists out here without first working out demand for service. I am happy to treat anyone of course but maybe the working poor should be the targeted dental patients for the NGO Mobile Dental Service. (Private Dentist 4)*

The fly-in fly-out private dentist felt that the services offered by the NGO MDS were limited and the unreliability of the service continuation made it difficult for fly-in fly-out dentists to maintain practice viability.

> *People who have been to the truck have said to me that they will never go back. They will wait for me to come back so that I can give them better, more complex dental options. Of course, some people don't want to pay, and the truck is free but that can't last forever and that is stuffing it up for the rest of us who make the effort to come out here. (Private Dental Practitioner 5)*

A dentist from the NGO MDS was respectful of the private practitioners in the regions visited and advised patients to seek regular care with the local practitioners primarily because of the uncertainty of the continuation of the free service.

> *Patients have told us they want to be our patient and what I don't want to do is for them to start depending on our service. For one, we are not sure if we are coming back, two we don't know when we are coming back, if we are, and three we are subject to funding and*

> *we may never come back. I try and get patients to take on some responsibility and to actually do that little bit extra and go for proper dental relationship developing. So, I try not to stimulate that dependence on us. (Dental Practitioner 7)*

Similarly, members of the rural primary care network often referred patients to distant dental practitioners in more major regional centres, rather than supporting closer rurally-placed dental practitioners.

> *We need to try to look after the dental providers who are out here also. Why send people to the dentist in a distant major regional centre, when you have got a dentist who is taking the time to come and visit in our regions, like the (Major hub community) dentist and the visiting one in Town F. We have a practice that has been helping us for the last 10 years that comes from a major regional centre and without them we would have drowned very, very quickly. (Dental Therapist)*

A resident private dental practitioner explained a positive experience of the visiting NGO MDS where it had helped to decrease the overwhelming workload he often faced in his rural community.

> *Well a brief history of my practice is that when I came in I was the only dentist around for 400km. So, I ended up with everything and I was snowed under. Waiting list of 6 months and I was poking along as fast as I could. But the dental landscape has changed a lot. We have the government dentists and the NGO Mobile Dental Clinic has 2 full time dentists in the van. This has impacted on me, but it hasn't been all bad because my books have dropped down a lot which is good as now people don't have to wait 3 months before I can see them. (Private Dentist 4)*

> *For the last few weeks I have been able to take an afternoon off and that has been great, I get a breather. I think the system they have in place now is pretty good. If you live in easily accessed outreach centres the NGO Mobile Dental Service come out twice a year which is really good. I mean that is better than service in a city! (Private Dentist 4)*

Participants reported the historically excessive workload placed on the public sector dental practitioners who were generally understaffed and overworked. All of the participants from the NGO MDS expressed their delight about the welcome received from the communities they visited and the impact they had on decreasing long waiting times for public sector oral health care in rural and remote communities.

> *I have had dealings with the government dental clinic in the hub community. They are more than happy for us to take their work load off them. That gets their waiting lists down. (Dental Assistant 2)*

Existing government dental personnel described their curiosity surrounding the NGO MDS when it arrived for the first time.

> *When the NGO Mobile Dental Service was here, I knocked on the door and had a sticky beak in there too. I spoke to the dentist on board and she had a new graduate dentist with her there too. (Dental Therapist)*

> *The NGO Mobile Dental Service was pretty flash and it would be cool to work in, it was an impressive beast. I must have something ticking over in my brain but when I see a flash new chair everything feels a lot nicer to work with. (Government Dental Practitioner 4)*

4.3.3.1.7 *Rural dental workforce shortages*

The unreliability of dental workforce availability was a significant factor contributing to poor oral health care provision in the Queensland communities included in this study. Although the NGO MDS had been visiting four of these communities once a year for three years, participants still thought that it was not often enough to provide effective oral health care to rural and remote communities.

> *It's difficult to recruit dentists to small places, also isn't it? I know in (Town H) they have struggled to get a permanent dentist there. We need a more regular service, not just this once off type of visit. (Nurse Unit Manager 2 Town H)*

> *What services? They are almost non-existent. A van coming once or twice a year is not "cutting the mustard". The truck comes once a year and we had a couple of Buddhist dentists who came and treated everyone for free a couple of years back apparently. The truck was here in June and they were flat out. They parked in the hospital grounds for two weeks. They had one dentist on for one week and then he flew out and a different one and a different driver flew in for the second week. (General Medical Practice Manager 2)*

Sometimes the unpredictable nature of dental workforce movement and retainment in rural and remote Queensland meant that often a hospital-based dentist had moved in to the region unbeknownst to the NGO MDS organisers.

> *Some people ask me how we decide what communities to go into. People ask if we use waiting lists times and we say, yes wait lists are a great indicator but in most of the communities we go into there is no wait list because aside from us there is no other service*

to wait for. Most of those communities we visit are fairly limited in numbers of resident dentists and there are other visiting dentists who come in. It's really quite common to do all the research (as to if a dentist services the community) because sometimes when you plan for the next year you find that a dentist has already moved into the region and we are even seeing a bit more of the opposite where dentists are leaving the Hospital Health Services. (Dental Practice Manager)

As reported in the results in the previous two case studies, it is not just dentists who were in short supply but also there was a need for more dental auxiliary practitioners such as dental hygienists, dental therapists, dental assistants, and dental technicians. A limitation to offering comprehensive treatments such as crowns, bridges and dentures was the lack of access to dental technicians to make these appliances, and the lack of time required to insert or cement the prostheses on completion of treatment.

Limitations are that there is no crown and bridge and denture work available. To do dentures out this way would be a big thing and not being able to make dentures would probably be the only thing I would say would be a negative. If you could get a technician to follow behind you and after you have taken out 11 or 21 or 22 or something, then if a technician could follow and make a little acrylic partial that would make all the difference to these people. (Dental Assistant 2)

4.3.3.1.8 *Funding uncertainty*

There was agreement among dental personnel from the NGO MDS about concerns regarding ongoing service provision due to uncertainty of continued funding. A major proportion of the funding is reliant on the generosity of the funding private mining company and with the present economic climate surrounding the coal industry, funding continuation was uncertain.

Patients have told us they want to be our patient and what I don't want to do is for them to start depending on our service. For one, we are not sure if we are coming back, two we don't know when we are coming back, if we are, and three we are subject to funding and we may never come back. We know we have funding for another three years, but a lot of these mining companies have gone bust. The private mining company funding the mobile dental unit are big, but they are highly dependent on what happens in the market and if that falls foul or whatever, which it probably already is, then we can't be sure of our funding. (Dental Practitioner 7)

We also do work under a finite budget, so much as we are so fortunate to have the private mining company providing the funding for us, there is a bucket or a set amount that we can work towards. (Dental Practice Manager)

4.3.3.1.9 *Exploitation of the NGO Mobile Dental Service*

Some participants was reported that there have been instances where some patients sought the free treatment offered in an exploitive manner.

I had a fair bit of feedback from the [Town E] community as well and I know people have gone to [Town E] from [major capital centre] to get their work done because, they were told by their private dentist in a capital city that they needed heaps of work, so they took a holiday to Town E and got all their work done whilst there for free. We have had patients from [nearby hub community] who see the private guys who fly-in fly-out from [capital city] and then the patients went to the dentists out in Town E to get it done for free. (Dental Assistant 2)

The system is not often abused. But actually, it happened, and we had people come in from a regional centre. They heard from a friend or a relative that we were free. Now this town has Queensland Health dentists and private dentists and these people drove into us and got seen. So yes, it does happen, not often, but it does happen. (Dental Practitioner 7)

Other participants had a different view and proposed that the system was not abused, but simply utilised.

I don't think anyone abuses the system because anyone who comes there is genuinely in need. I think the only thing in question is; why are people accessing the service? Is it an access issue or is it an affordability issue? (Dental Practice Manager)

4.3.3.2 *Influence of visits by the NGO MDS on rural communities*

This third case study examined the impact of the NGO MDS on the quality of life for patients that had access to this dental service. The reasons cited by participants, that patients sometimes did not attend the free dental service included: poor compliance with appointment attendance due to lack of oral health awareness, the necessity to take time off work to travel the large distances to access oral health care, the mental anguish associated with actively seeking care, fear of dental treatment, and concern by the patient of the lack of continuity of service such that they continue to only visit their long term, often remotely located, dental practitioner.

4.3.3.2.1 *Patient compliance difficulties*

Some participants reported that some residents in rural and remote communities were ambivalent towards the importance of good oral health and did not present to the NGO MDS for scheduled appointments.

> *It was more the irresponsibility of the patients. Most of the patients had dental work to be done but they didn't pitch up you know. (Dental Practitioner 8)*

Lack of compliance for dental appointment attendance was compounded by the inability of the NGO MDS to contact some communities upon arrival, especially some Indigenous communities where there are no telephones and issues of cultural sensitivity are evident. The participants from the NGO MDS described instances where the Director of Nursing at the hospital and the local police were asked for their help to notify patients of their obligations to attend booked appointments.

> *It's more common in Indigenous communities than others but in one Indigenous community, we couldn't make any bookings because nobody had any telephone numbers and the DON had to make all the bookings and at one stage she was away [looking for a lost backpacker] and we employed the local copper who took his van and rounded up all the patients. (Dental Practitioner 7)*

> *In some of our communities, particularly the Indigenous communities we have a lot of "fail to attend" appointments. The rate per visit might be that we have 16 "fail to attend". Our worst example was in one particular Indigenous community, and so we worked very closely with the DON and said that we needed to promote the importance of the service and obviously that those people on the list need to come in, and if they can't make it then making sure they ring up and cancel that appointment. Sometimes we get the policeman out to find the people we are looking for. (Dental Practice Manager)*

4.3.3.2.2 *Time off work*

Large distances to travel to the hub communities where the free dental service was parked often meant that effective post-operative care could not be received. The impact of the community service was such that the rural and remote patient still required time off work at a time suitable to the free dental service, which was often not at a suitable time for the patient.

> *The truck or a mobile unit would be great, but they only pick up the problem when the dentist is there, and this might not be a convenient time for the patient. It might be*

mustering or bad weather conditions or something where the patient can't drop everything and come in because it suits the dentist visit time. (Mental Health Nurse)

A lot of the problems in accessing treatment is the travel involved to get things done. Especially the station guys as well, they are the hardest guys to get to an appointment. They say" I'm too busy, I've got stock to feed and cattle to do this with and I have to do this and that" and I say, "well we are only in your area for this amount of time and you really need to make time". A lot of the wives are really pushing them to come in because we are a lot closer to the properties and so our service has a really big impact on that sort of demographic. (Dental Assistant 2)

4.3.3.2.3 *Mental Health*

Poor oral health was reported to have a negative effect on the lives of individuals in the communities previously studied in Case Studies 1 and 2. Similarly, The NGO MDS dental personnel reported that people with oral health issues in the outback communities they visited, also often did not seek treatment because they are were used to not having easily accessible oral health care. They described how residents often put up with pain in many instances, rather than seeking medical or dental assistance. Time restraints and the necessity to prioritise emergency dental appointments by the NGO MDS, meant that some residents might miss out on an appointment for a routine procedure which caused significant mental anguish.

I think that they just breed them tough because they know that they can't just get to the dentist and people just aren't as pro-active about their health and particularly their dental health. (Dental Practice Manager)

There was a waiting list to see the NGO Mobile Dental Service and not everyone gets seen and then there is a long wait till they come back again. (Pharmacist 10 Town H)

4.3.3.2.4 *Fear*

Some participants reported that they felt that fear of dental treatment was more common in older generations and attributed this to their past experiences. It was reported by other participants that the NGO MDS had a very positive effect on the lives of some people in rural and remote Queensland, especially children who looked forward to the van's visit and were no longer frightened.

Fear is the number one barrier, absolute fear. A lot of the older generation have this fear of the anaesthetic not working and of the knee on the chest to pull out a tooth. The impact of the NGO Mobile Dental Unit has been awesome. In some communities, we have seen a

massive change, especially in the kids. When you get to a new town, only the brave will come first and then word spreads such as "they're awesome, they do this, this and this. They don't hurt". Once this word spreads then you get all those others who are a little bit afraid and they will come. They then tell everyone, "yes they are awesome, and they are fantastic". (Dental Assistant 2)

4.3.3.2.5 *Continuity of care issues*

Building a rapport with the same dentist over a long period of time was described by participants as an important factor in the dentist/patient relationship. This lack of trust in the continuity of care, where the same dentist would make repeat visits, was a concern reported by some participants that they felt residents experienced in choosing to attend the NGO MDS or not. Some patients continued to support their local dental practitioners or travel to major centres to have treatment with their long-term family dentist. Due to funding uncertainties, many patients were encouraged by the NGO MDS to take responsibility for relationship building with local dentists in the region.

I try and get patients to take on some responsibility for their oral health and to actually do that little bit extra and then to go for proper dental relationship developing. So, I try not to stimulate that dependence on us. (Dental Practitioner 7)

4.3.3.3 *Communication and referral pathways*

This section reports on the referral pathways and communication successes and breakdowns between oral health care personnel on board the NGO MDS and specific groups within the rural primary care network, and with existing rural and remote dental personnel.

4.3.3.3.1 *Interprofessional Communications*

Almost all of the participants from this research project reported the siloed nature of interprofessional communications between dental practitioners and the non-dental primary care networks. These findings were corroborated by results from the newly introduced community, Town H.

There is no communication that the government dentists are coming to Town H. I think that's the thing, it's a bit like mental health, they [dentists] could be here in town and we don't even know they are here. I think it is because we have all these siloes of people reporting to all different places now. There is not really that great network where they might tell us when they are visiting or what services are being provided this week. I could send the information out to all the staff in one email if I had the information given to me,

then we wouldn't send a patient to the dentist because we would know they are not here. (Director of Nursing 6 Town H)

I don't know the dentist's availability and their opening times. (Pharmacist 10)

The NGO MDS providers explained that the communication difficulties were often due to the changeable nature of rural employment situations for General Medical Practitioners, Pharmacists and allied health care providers in rural communities.

So, it is really always liaising with the councils and they are always really supportive to get us on-board, the Hospital Health Services themselves and the DON's, and because the staff are always changing, year on year off you may be talking to someone completely different. (Dental Practice Manager)

The NGO MDS dental personnel believed that they made a greater effort to communicate with the rural primary care network than they received in return.

The information sharing from QLD Health [about patients with dental problems] to us is not as good as the information sharing that occurs from us to them. (Dental Practice Manager)

This third case study examined interprofessional communications that existed between the various different types of dental and non-dental primary care providers interviewed. Four specific subgroups of participants were directly involved in the logistical arrangements for the NGO MDS and were often contacted by the NGO MDS personnel when the service was due to visit their communities. These four groups of people were identified within the larger primary care network group and included: General Medical Practitioners, Pharmacists, Directors of Nursing (DON's) and other members of the rural communities. The "other members" included hospital administration staff, medical practice managers, police, teachers, local councillors, and hospital cleaners.

Communication with General Medical Practitioners

Dental personnel reported that the nature of communications with General Medical Practitioners in the communities visited by the NGO MDS was described as poor or non-existent (13)

A doctor has never rung me to ask advice? That has never happened. We have no professional relationships with the doctors. None what so ever! They only treat us as professionals if they need us but not the other way around. So, you don't get to see the doctor most of the time. Town H and another town nearby have got the biggest hospitals however I have never met any of the doctors in either of those 2 places. (Dental Practitioner 7).

According to the dental personnel, the transient nature of locum doctors with short contract terms, and the relatively short stays of the NGO MDS, often inhibited building successful inter-professional relationships.

> *Sometimes we know who the doctors and pharmacists are and it's a case of the one's that we meet are not stable. So, it is usually a fly-in, fly-out doctor that comes up and does a three to six-month stint and then they go again. Then another one comes up from wherever. The rural areas are struggling for anything medical, it a huge problem. (Dental Assistant 2)*

> *The doctors are not the same ones (doctors are locums). (Dental Practitioner 8)*

One dental provider on the NGO MDS described an example where post-operative instructions for a dental extraction patient were offered to a General Medical Practitioner and was met with indifference.

> *Well normally what I do is once we are getting close to when we will leave, because I try not to do extractions on the last few days before we leave but that doesn't always work because you are dealt what you are dealt, and you have to deal with whatever is in front of you. So, I don't want any infections once we are gone so the only thing, I tell them is, listen, if our patients come in post extraction with an infected socket, this is what you need to do, and I tell them. I see that their eyes glaze over straight away, and they don't want to listen. (Dental Practitioner 7)*

Occasionally a General Medical Practitioner demonstrated a lack of understanding of treatment options and outcomes of dental disease.

> *But we don't really talk to the doctors or pharmacists. But in Town F we have had a few dealings with the doctors there. They are Indian were more aloof and one of them had really bad periodontal disease and we tried to explain it to him and he laughed it off as if to say, I am a doctor and I know better than you because I have medical training and I know how to deal with my problem better than you and I felt like saying, "Well mate you don't because you are not brushing your teeth and you are not flossing them". (Dental Assistant 2)*

> *I don't think it is just the General Medical Practitioners maybe they don't connect because that is what they have been exposed in the past by dentist attitudes to them. I don't think it is one-sided. I think we are ahead of the game by trying to connect with doctors, but it hasn't always been that way. We have a good relationship with QLD health oral health*

> *departments but not with QLD health medical departments. Actually, I don't think we have any relationship with them. (Dental Practitioner 7).*

There was one example reported of positive collaboration where a doctor requested advice about dental post-operative care

> *So, the only professional relationship we have had has been haphazard. The only place I have met the doctor was in Town E. We were attached to the doctor's surgery and the toilets were in the doctor's surgery and so we met the doctors there. In Town E, I told the doctor how to treat a dry socket because I did actually treat her husband, so I told her how to do it. (Dental Practitioner 7)*

Communication with pharmacists

Interprofessional communication between dental personnel on the NGO MDS and pharmacists was also described by participants, as generally poor. There were six examples of poor communication given and only one example of any attempt at inter-professional relationship building.

An example of minimal interaction was given by the locum pharmacist in Town H.

> *The NGO Mobile Dental Service was just here for two weeks out of my five-week stay. They put up notices in the pharmacy window and shop windows and advertised in the "Town H Community Forum Magazine". They were very busy, and we had a few patients come to the pharmacy and I tell the patient with a toothache to call the 1800 number [NGO Mobile Dental Service].I never contact them myself. I have never had to work with a dentist if a patient had a chronic medical condition. I have never contacted a dentist directly to ask for advice. (Pharmacist 10)*

The majority of the dental personnel from the NGO MDS described no interprofessional interaction with pharmacists.

> *We have no professional relationships with the pharmacists. None what so ever. (Dental Practitioner 7)*

> *Pharmacists never contact us, only if we have written out a script and we avoid that as much as possible because the rules about giving patients antibiotics prior to dental treatment have changed over the last few years and so there is not that real need to have that sort of contact. You usually only hear from the pharmacist if there is a problem with their script or with what they have got. They might ask if they can give them this instead of that if they haven't got the right thing. (Dental Assistant 2)*

The NGO MDS recognised the need to improve interprofessional communication between themselves and pharmacists in the communities they visit.

> *I think the way we promote the service is important, bringing the pharmacist on board if we don't already and letting them know what we are there for and that we might be writing scripts for patients that might need to get some pain killers or antibiotics after they have been in to see us. So, those connections are really valuable in each location. (Dental Practice Manager)*

Dental Practitioners often prescribed medications and specific oral hygiene products for their patients, to be purchased from pharmacies. These dental personnel suggested that this would be a good time for pharmacists to engage with them to form interprofessional collaborations.

> *Pharmacists could stock many more dental products, like disclosing tablets for the kids. Prevention is always better than cure. That has always been my philosophy. Even the pharmacy assistants wouldn't have a clue about how to use a piece of floss or even what it looks like. Even in some places that we go to the kids have braces and I don't know whether they are not shown at the orthodontist or they have forgotten or whatever, but super floss is not used. With the amount of people going overseas now for bridges and they don't get that post op care and have never been taught to use super floss. The pharmacist could perhaps help these patients by educating them. (Dental Assistant 2)*

The pharmacists described their knowledge of dental product suitability as being derived mainly from personal experience rather than direct examples of inter-professional collaboration with dental professionals.

> *My own personal experience influences my recommendations of oral health care products. (Pharmacist 10)*

Communication with Directors of Nursing (DON)

The most positive examples of effective communications were between dental personnel from the NGO MDS and Directors of Nursing (DON's). In most instances, this relationship was described by participants as a good one. However, sometimes there were reported communication issues.

Often the DON's in hospitals were long term residents in the communities and they had been in their professional role for many years. They oversaw the employment of locum doctors, nursing staff, and were responsible for the organisation of visiting allied health services. They were often the first point of contact for the NGO MDS.

> *The most stable person is the DON at the medical practice and in saying that, most of the towns that we go to have DON's who have been there for two, three or four years. Some of them have been there for years and years and have no intention of moving because they are quite happy there because that's their life. (Dental Assistant 2)*

> *We communicate with the Hospital Health Services themselves and specifically the DON's because the other staff are always changing, year on year off you may be talking to someone completely different. (Dental Practice Manager)*

> *But I really think that in most places we go to it is the DONs. See only a few places three or four that we go to have doctors and the rest are Queensland Health and most of them are just clinics and there is no doctor. The ones that do have doctors are on shifts and you don't get to see them. The only contact you have is the nurse's station and possibly the DON. So, you don't get to see the doctor most of the time. Mostly they are the same DON's, but you do get relieving DONs. (Dental Practitioner 7).*

The Directors of Nursing described their appreciation for the NGO MDS.

> *We have the truck which was here earlier in the year and that is great. (Director of Nursing 5)*

It was not uncommon for Hospital DON's to take an interest in raising oral health awareness in their communities as a direct result of inter-professional communication with the dental assistant on board the NGO MDS.

> *But when we went to one community the DON there was awesome. She was rounding up patients for us and she cared, and I gave her so many pamphlets and stuff and she handed them out and she was all for it. She was asking questions like "how do you do" that and "what do you use that for?" (Dental Assistant 2)*

Good relationships were developed between the Director of Nursing at medical facilities in the communities visited and the dental personnel involved in the logistical arrangements for the arrival of NGO MDS truck.

> *It is the dental assistant who is the long staying dental nurse on our truck who has been here since the beginning who makes the most contact. The dental assistant and I try and do our upmost to get a personal contact with the DON. The dental assistant is quite good and knows most of them by name. For instance, what we do is when we get to a location and we need some stores, the dental assistant will contact the DON when we are in the rotation before and tell them that we are going to send some stores there. That gets delivered to the*

clinic and then we go and get it. So, there is a close relationship with most of them. (Dental Practitioner 7)

The only other person, other than myself, to speak to the DON's is the logistics person and they will talk to them about moving the truck around and where the keys are going to be dropped off. So, I will call them the year before and then a month out to make sure there are no issues around us coming. Then we give them a call a couple of days prior to tell them, we will be there at 2 o'clock on Tuesday or whatever? (Dental Practice Manager)

Participants however, reported some examples of poor relationships between dental personnel of the NGO MDS and Hospital DON's.

Some of the places we go there is only one person there. Not always do we have a good relationship with the DON. They sometimes feel like we are stepping on their toes. This last rotation was definitely like that. The DON was not very impressed with us using the toilets. The DON was only there on temporary service also. The DONs that come out of the cities to do relief have different attitudes also. There is often very little communication with the relieving ones in some of these areas we go, because when you finish your nursing school you don't say "I'm going to go to the furthest place I can possibly find, and I will work there for the rest of my life." Unfortunately, they are pushed out that way because they don't work well with others. (Dental Practitioner 7)

Communication with other members of the rural primary care network

The most positive examples of effective communication between dental personnel on the NGO MDS and the rural primary care network existed with the administration staff in hospitals. These communications were commonly about arrival times and promotional activities to raise community awareness.

I still feel that if you have the administration of the little hospital behind you, you can, even if there is a change in the medical service, you can have a little bit of stability that way. And just give them that harmony of what we are doing and what they can expect from our service. (Dental Practitioner 8)

In Town F have a good relationship but that is mainly with the admin staff more so than the doctors themselves. (Dental Assistant 2)

They talk to the admin more than to me. We just know when they are coming. They ring to notify us of when they are coming. The NGO Mobile Dental Service send us posters and stuff to let us know when they are coming about a month prior to them coming. As soon as the community is aware that the dentist will be in town they ring, and we give them a number

> *and then they ring and book for the NGO Mobile Dental Van or for the dentist her they get an appointment. Otherwise they might speak to the admin ladies who might know when both lots of dentists are coming. (Nurse Unit Manager 2)*

Nursing staff including Registered Nurses (RN's) and Enrolled Nurses (EN's) were also often responsible for the facilitation of good communicational pathways. The dental personnel on the NGO MDS were also building relationships with non-medical members of the communities such as hospital cleaners, medical Practice Managers, local policemen and teachers.

> *We definitely are developing relationships in the towns we go to now. Town E is a classic, we go out with the medical Practice Manager for dinner. We go out to dinner with her and also the policeman and teachers and people like that there. Town H is very good, they are awesome, and the nursing staff are who we have dealings with rather than the doctors. We have dealings with the DON's, the RN's, the EN's and even the cleaners. They tell us where the toilet is and they show us how to get there. It's the little things like that that make our job even easier. Because we are in the middle of nowhere and you need a toilet. (Dental Assistant 2)*

> *It's more common in Indigenous communities than others for instance we sometimes can't make any bookings because nobody has any telephone numbers and the DON had to make all the bookings and at one stage she was away (looking for a lost backpacker) and we employed the local copper who took his van and rounded up all the patients. (Dental Practitioner 7)*

Transportation to access the NGO MDS was sometimes an issue and regional co-ordinators and local city council members made direct contact with the dental personnel to facilitate treatment for their residents.

> *Now that we have been going back into these communities for the second and sometimes third times, there is getting much more acknowledgement about the service. People know that we are coming, they are more used to the marketing collateral that goes out. I do get calls from time to time from regional co-ordinators and councils who may have heard about it through a drought co-coordinative group or someone else may have mentioned the service. And we try to interact with the councils wherever we can. Some of the councils put on a shuttle bus, but we have only had this in a couple of communities. I negotiate that shuttle bus with the council and it is usually in the smaller towns and sometimes it is the community RSL that we can tap into that. (Dental Practice Manager)*

Different levels of communication existed between dental personnel on the NGO MDS experience and each of the four professional subgroup types. The poorest communications occurred between General Medical Practitioners and the dental personnel from NGO MDS (13) and pharmacists also showed poor interprofessional communications (6). Only one example of good collaboration was found with General Medical Practitioners. The most successful communication occurred with the hospital administration staff, nurses at primary care clinics and hospitals, and with non -medical community members (14). Directors of nursing also were very strong communicators with dental personnel (8).

Communication with existing local or fly-in fly-out dental practitioners

The selected communities visited by the NGO MDS received intermittent oral health care provision by various other intermittent dental services including: a visiting government dental practitioner, a visiting government oral health therapist, a fly-in fly-out private dental practitioner and, a remotely placed resident dental practitioner who accepted patients that travelled to this private dental practice from outlying communities. Communications were examined between these four oral health care providers, and the dental personnel from the NGO MDS. Intra-professional communications between the dental personnel on board the NGO MDS and these dental providers differed significantly depending on if those providers worked in government or private practice. Communications with government dental personnel was generally effective with seven examples of positive comments. However, the intra-professional communications with private dental practitioners showed only three comments expressing satisfaction with these collaborations.

Communication with existing government dental personnel

Most of the dental personnel from the NGO MDS reported good intra-professional communication with Queensland Health Government Dental Practitioners (n=7).

> *We have close ties with Queensland Dental Health and with their head office and the Chief Dental Officer in Brisbane. So, we have referral lists that they produce and send on to us regularly. This is the first mobile dental truck nationwide for the NGO, so we keep checking in with them to see how their dental service runs so we are keeping to the right standard. I like to think we are at a much higher standard but that's just my opinion. (Dental Practice Manager)*

Dental personnel of the NGO MDS described better relationships with government dental departments than with government medical departments. The NGO MDS dental practitioners described that the government dentists in the region welcomed them to relieve the overwhelming workload on the public dental system. Performing multiple restorations in

appointments without being bound by the reported governmental "one tooth, one visit policy" enabled the NGO MDS practitioners to help with the waiting lists for government dental patients in rural and remote Queensland.

> *We have a very close working relationship with Queensland Oral Health Departments but not with Queensland Health medical departments. Actually, I don't think we have any relationship with them. We have given the oral health departments our rosters however on one of our rotations these rosters coincided. However, this didn't have much of an effect. I can refer a denture case to them once I have done all of the extractions. Unfortunately, because of their one tooth, one visit policy they didn't have much of an impact on what we do to the patients anyway because we do so much more than they do anyway in that one sitting. So that patient with us is many more months down the treatment path with us than they would be with them. However, we do work quite closely with them as far as dates go but I am afraid it doesn't always work out that way. (Dental Practitioner 7)*

> *In some communities, we seem to have gotten on top of the severest dental problems and plus Queensland Health are doing a fair bit of it now regularly also. So it is the working between the two services that seems to be helping. You can definitely see the amount of acute and chronic dental problems decreasing. I have had dealings with Barcaldine and they are more than happy for us to take their work load off them. That gets their waiting lists down. (Dental Assistant 2)*

The government dental practitioners expressed admiration and even envy for the quality of the equipment on the NGO MDS.

> *The [NGO Mobile Dental Service] was pretty flash and that would be cool to work in, it was an impressive beast. I must have something ticking over in my brain but when I see a flash new chair everything feels a lot nicer to work with. (Government Dental Practitioner 4)*

A government dental therapist expressed her frustration with the lack information sharing between the NGO MDS personnel and the government dental personnel. She describes the lack of feedback from the NGO MDS as to which of their government patients received treatment. This made record keeping and appointment tracking difficult with the consequence that waiting lists for government appointments were often inaccurate as treatment was completed with the NGO MDS.

> *It's really hard though because we have no real official interaction with them and so it is hard to know how many of our patients actually went to them because they treat private and public, it doesn't make any difference. They don't access our lists and we can't access*

> *their lists and so we don't know who has actually seen them. There is no feedback from them at all. I rang them after their visit to Town E and Town G and to find out how it all went, and I had a patient from Town E that I needed an OPG (a detailed dental X-Ray) taken, so I shot them towards the NGO Mobile Dental Service. If there was more interaction between the likes of myself and this service delivery, then it would be great. (Dental Therapist)*

The actual numbers of patients that the NGO MDS have taken from the government dental clinics had not been collated, due to lack of information sharing between the two oral health care delivery services.

> *We have asked the patient to sign a consent form for the patient to share a patient treatment summary with the Hospital Health Service and if they have consented to do that then we can pass that information over. They want the hard copy, can you believe that in this day and age, but we would like in return from them information about how many people that we then took off their waiting list. That would be a bit of a political hot potato because then it would look like the NGO Mobile Dental Service have come in with their big truck and reduced the waiting list by 80% or something. So, they are not keen to give us that information although I know it occurs and so do they. (Dental Practice Manager)*

The lack of communication and coordination between government dental clinics and the NGO MDS meant that patients often reported to oscillate between the two services. An example was from one of the targeted communities where the government dental therapist tried to explain that a specific aged care rural and remote dental plan was in place in the region and the NGO MDS visit overlapped with this government dental visit, resulting in confusion due to unsuccessful intra professional communications.

> *Town E is primarily an aged care area and we had a rural and remote system that went over there for a little bit but that back-fired on us a bit. I spoke to the manager of the truck when it first started a year or so ago and explained to them that we had a rural and remote care program that went to Town E and he said that they would be going to Town E also. I said that would be great but better if they could leave it for 6 weeks until after our dentist had been and then these patients could get follow up care if they needed it. Of course, that didn't happen, they came 2 weeks after we had been and there were a lot of double ups of treatments and people turning up for second opinions. It was a bit futile. It didn't work the way that it should have done because there was no communication. (Dental Therapist)*

Communication with existing private dental practitioners

Dental personnel from the NGO MDS reported making the effort to communicate with any fly-in fly-out dentists in communities they visited, however in the four communities studied, the private practitioners and fly-in fly-out practitioners reported never meeting them. Only the government dentist and the dental therapist indicated that they had met with some of the staff from the NGO MDS.

> *Most of those communities we visit are fairly limited in dentists and there are other visiting dentists who might come in. Obviously if there is one in town then our dentist will go in and introduce himself and chat with them. (Dental Practice Manager)*

4.3.3.3.2 *Referral pathways*

Two-way referral processes between the NGO MDS and from the rural primary care network members were generally informal in nature. Dental personnel on the NGO MDS discussed instances where they received a phone call from a member of the primary care network asking them to see a patient with a dental issue.

> *Doctors can refer, we have no objection to them doing that. Sometimes they are just a verbal referral. We had a few in Town G, where the patients came down from the hospital. A special mental health outreach unit rang us from a regional centre requesting that we see some of their patients. They said "Can you see this group of people? They know people who have been to your service and have absolutely raved about the wonderful treatment they got. So, can we get them in?" The hospital rang us and said they had a patient there complaining of a toothache and we saw them. Town H have rung us up a couple of times. We don't get it a lot, but it depends on who is in the town at the time and what is happening. (Dental Assistant 2)*

On rare occasions, a formal referral letter may be received from a General Medical Practitioner.

> *We have had a couple of referral letters come in, there are probably two that I am aware of. Not a great deal and I think those referrals depends on what time we are there, and in some areas, that is probably co-ordinated a little bit better than in other areas and that would be the DONs letting their other medical staff members know we are there and connecting with their primary health care networks. (Dental Practice Manager)*

The dental personnel from the NGO MDS reported responding to written referrals with letters showing patient treatment reports or a phone call was made to say that treatment had been completed, demonstrating the lack of a formalised two-way referral protocol.

> *We got a few referrals from a doctor by letter. Once we had treated the patient, we wrote a letter back saying the treatment had been completed. (Dental Practitioner 7)*

> *The dentists normally send responses back to referral letters but that would probably be more Sharon who will call up and say "Thanks we received this "and then she makes contact directly with the patients and tells them when we are coming. (Dental Practice Manager)*

The booking procedure for dental appointments was patient-directed. Often the primary care network simply gave the patient the 1300 phone number to the NGO MDS, and the patient was responsible for the appointment.

> *I tell the patient to call 1800 number for the NGO Mobile Dental Service or to call nearby regional centres. (Pharmacist 10 Town H)*

4.3.3.3.3 *Appointment Booking and Notification of NGO Mobile Dental Service Arrival*

The Directors of Nursing in Indigenous communities took an active role in appointment making due to the lack of telephone access of community members.

> *In Indigenous communities for instance we can't make any bookings because nobody has any telephone numbers and the DON has to make all the bookings. (Dental Practitioner 7)*

Dental appointments for the NGO MDS were made either directly by dental personnel on board the truck or by dental assistants at the NGO base in the major regional centre (Townsville).

> *The person taking the calls from a major regional centre if the DA on board is away does remind them to bring their Medicare card, we don't ask them about their private health insurance, but we do go through the QLD Health triaging system. So, she will go through that questionnaire and ask them some basic questions like "are they experiencing pain or are they just coming in for a check-up". If they have pain, then the questions try to localise where the pain is and then these things are put into the patient notes. (Dental Practice Manager)*

Staff from the NGO MDS were taught the correct triaging for dental appointment urgency, and appointments were giving accordingly.

> *If it is acute pain, then all the DA's on the desk are trained that there is always an appointment available. That's just standard for a toothache, we kept at least one appointment free a day for that. We don't book up the full two weeks before we get to a town. We do kind of prioritise for example if someone rings up and leaves a message on our*

> *answering machine and says they have been on antibiotics for three weeks and I need to get this work done, then they are a priority because we know that the antibiotics are not going to cure the problem, it's only the removal of the tooth that will help them. If someone has broken a tooth and that is causing them pain, then they are the next priority down. It they have a broken tooth and no pain then they are the next one down. If they just want a check-up then they are the bottom of the list. (Dental Assistant 2)*

Perhaps the most noticeable examples of communication between the NGO MDS and the rural primary care network occurred regarding the notification of the arrival of the service. Not only were the medical facilities notified, but advertising flyers and posters were placed in pubs and community centres also, so that people were made aware of the impending visit and could contact the service directly for an appointment without needing to have a referral through a medical facility.

> *What happens is that our PR department have fliers and posters, and these posters get sent out about 4-5 weeks prior to us arriving in the community. They have our dates and telephone numbers. We send that to the pubs and community centres and the clinics obviously. And they all get posted up. When we get there, these posters are literally everywhere. We are welcomed with open arms. The other thing is word of mouth and what happens is that in the first week we are there we normally get the locals who are in town and in the second week we get the stations. (Dental Practitioner 7)*

> *They put up notices in the pharmacy window and shop windows and advertised in the 'Town H Community Forum Magazine". (Pharmacist 10 Town H)*

Advertising also occurred on local radio stations, describing the free dental service to allow people the chance to plan their visits and ring to make appointments.

> *We also do radio marketing. I usually do 3 interviews a year around all our ABC stations on North West Radio. Every once in a while, I love to put the dentist in the hot seat as well when we have a clinical spin on the interviews. But a lot of the time we are just taking about; when the service is coming, what people should come in for and those kinds of activities. (Dental Practice Manager)*

The DONs and Hospital administrators were contacted directly by the state manager of the NGO MDS and plans were made for the coordination of the visit by the 18-wheeler semi- trailer truck. The truck driver may also be involved in this communication process to facilitate the correct location and delivery details.

Basically, by September this year we will have the schedule locked in for next year. We plan quite far in advance and so we speak to the HHS districts and it's usually the DON's that look after the facility that we go to and we plan with them. Then what we start to do it put together (on our website) a handout brochure which is a three-folded handout and then some clinic posters that go out to all those places we will visit. The only other person, other than myself, to speak to the DON's is the logistics person and they will talk to them about moving the truck around and where the keys are going to be dropped off. So, I will call them the year before and then a month out to make sure there are no issues around us coming. Then we give them a call a couple of days prior to tell them, yes, we will be there at 2.00 o'clock on Tuesday or whatever? (Dental Practice Manager)

4.3.3.4 *Interest in teledentistry*

Participants from this third case study were asked their views on the utilisation of intraoral cameras/teledentistry and enhance interprofessional collaborations by including dentists in treatment planning teleconferences.

4.3.3.4.1 *Intraoral cameras/teledentistry*

Three participants showed interest in the possible uses for intraoral camera technology/teledentistry to receive triage advice for the oral health issues of their patients from remotely located dental personnel.

It could be useful because you could get a generalised look at what the overall mouth looks like, and you'd actually see a lot of problems, that people have with their mouth, that they might not be aware of. I think that could be useful, as long as someone was to come and show us how to use all the technologies. (Nurse Unit Manager2)

A Director of Nursing from Town H described an alternative to the intraoral camera technology that was already being used in their medical facility to get advice from non-resident dental professionals. This participant used an iPad to send oral images to a dentist to get triage advice.

We have an iPad to take a picture and show the dentist what we are looking at and so it's not out of the realm these days is it? (Director of Nursing 6)

Intraoral cameras were described by one dental participant as an efficient tool for dentist to dentist or dental specialist communication.

I think that would be of benefit provided we had the infrastructure in place to have that kind of shared system. Yes, that would be useful and then we would have the ability to send

> *images to orthodontic specialists for opinions or someone who would do some crown and bridge work for us or something. (Dental Practice Manager)*

A dental practitioner responded that they did not believe that the use of this technology would benefit the patients because the non-dental care provider would not have the necessary equipment or skills to carry out any emergency dental care.

> *Intraoral cameras will help in communicating but I can't see how it will be of any benefit to the patient. Because as you know dentists do dental treatment and we can't do that over the phone. I think it would be nice to have but I don't think it will make any difference to the patients. Yes, it's all nice to have these in the cloud ideas but people like us who are in the field won't use it. (Dental Practitioner 7)*

Three participants from this third case study were unsure as to the use of intraoral images as an effective triage method. The expense of installing the technology was reported as a possible issue.

> *Well it just depends on whether or not it would be used. Would the expense of the outlay be worth the outcome? I think a picture taken with an intraoral camera would help triage dental problems. If they want advice and we are in the area then if they ring me, and because I have been in this job for so long, if I ask the right questions I can pretty much guarantee that I can diagnose the problem over the phone without a photo. (Dental Assistant 2)*

However, some participants were concerned about the logistics relating to teledentistry and that the expense to set up the teleconferencing would be difficult to justify.

> *In Town H we have a telehealth set up in the emergency room and you could do a consultation whist the patient was in the bed. The problem is that we operate a 24 hr a day 7 day a week facility and most dental emergencies occur after hours, so you would need a remote dentist on call for all of that time out of hours and how would that be remunerated? (Nurse Unit Manager 3)*

> *With teleconferencing, well I don't know if you need to go to the added expense. (Dental Assistant 2)*

One dental practitioner was unfamiliar with the technology.

> *I have never used this. Yes, that is a pity isn't it especially in today's life with all the technology. (Dental Practitioner 8)*

4.3.3.4.2 *Teleconsultations*

Participants were asked their views about including dental practitioners in teleconferencing patient treatment planning appointments.

Three participants were enthusiastic towards including dental consultations in existing tele-health consultations. They described instances where other non-dental allied health care providers were already included in such discussions.

> *Another option is TEMSU which is a "Tele-Emergency Medical Support Unit ". They have facilities for communications for nurses to nurses and doctors to doctor basically clinician to clinician, and they are certainly looking at mental health, at the moment. All paediatric admissions we talk to them first. Mental health is not yet incorporated because we have video conferencing for them. Maybe dental consultations could hook into this also? (Director of Nursing 6)*

> *That telehealth/dentistry thing sounds good for the times between dental visits. That would work here because if anyone had any concerns, we could be sitting here with them and then have a telehealth consultation, then the telehealth team could then book them in if necessary, to the dentist. We would then send out the appointments and that would mean we had follow-up from the telehealth and that would benefit all the guys in all the rural areas. We do it for mental health, paediatrics outreach, oncology outreach and cardiology every so often for renal. (Nurse Unit Manager 2)*

Two participants indicated that including dental consultations in teleconferencing appointments, would be of limited use due to generalised poor internet access and unreliability of phone coverage in many of the outreach communities.

> *Teleconferencing? A doctor has never rung me to ask advice. That has never happened! We have 3G and our software backs up to base every hour. Yes, we have internet access if it is available. For example, in one outreach centre, we were told there was 3G but wasn't. We were told they had 3-phase power and they didn't. Another outreach community doesn't have anything. So, when we get there, we have a satellite dish and we can only communicate through satellite. You can't get mobile phone reception. (Dental Practitioner 7)*

One participant was unsure as to whether oral health care consultations should be included in teleconference meetings.

4.3.3.5 *Strategies to improve the oral health care provision.*

When asked how to improve oral health care provision, participants from this third case study identified similar strategies to those in the first two case studies to improve oral health for rural and remote communities in Queensland. These strategies once again supported improving oral health service provision, promoting community oral health, upskilling the non-dental primary care network in dental emergency knowledge, increasing the dental workforce, and increasing oral health funding.

Participants from all three case studies were questioned about the possible strategies they felt that the NGO MDS might use to improve oral health care provision to the rural and remote Queensland communities.

Four major strategies to improve the effectiveness of this NGO's free service's provision of oral health care to patients in these communities included: oral health promotional activities (31), offering better service provision (23), increasing dental workforce numbers and, upskilling the existing non-dental rural primary care providers. Within each of the major themes have emerged subthemes that are specific to the service offered by the NGO MDS.

4.3.3.5.1 *Oral Health Promotion*

The most commonly suggested strategy by participants from this third case study to improve service provision by the NGO MDS was to increase the oral health promotional activities associated with the service. This was described by strategies which included: increased advertising and promoting of the NGO Mobile Dental Service (11), building community oral health awareness as to the importance of good oral health and attendance to the NGO Mobile Dental Service (9), increasing the emphasis on preventative oral health care by the NGO Mobile Dental Service(8), offering diet advice for good oral health (1), providing free toothbrushes (1) and, encouraging water fluoridation in rural and remote communities (1)

Advertising and promoting the NGO MDS: Participants encouraged further promotion of the NGO MDS and the services it provided, to boost attendance rates to this free dental service.

> *Communities are always surprised to find that we do dental treatments for free. (Dental Practitioner 7)*

Instances were described where respected community members offered their help to distribute promotional materials which encouraged trust and endorsed the service with community members.

> *In one community, the DON there was awesome. She was rounding up patients for us and she cared, and I gave her so many pamphlets and stuff and she handed them out and she*

> *was all for it. She was asking questions like how do you do that and what do you use that for. (Dental Assistant 2)*

Advertising of the service was reported to result in relationship building between the NGO MDS and non-dental primary care providers, with the increasing of awareness of the free services provided.

> *I think we will improve relationships with the non-dental primary care network just in terms of advertising and promoting the service. I usually do 3 interviews a year around all our ABC stations on North West Radio. Every once in a while, I love to put the dentist in the hot seat as well when we have a clinical spin on the interviews. But a lot of the time we are just taking about; when the service is coming, what people should come in for and those kinds of activities. (Dental Practice Manager)*

Participants reported incidences of their co-operation with the requirements for advertising the arrival of the service including displaying posters in pharmacy windows and the distribution of the relevant contact phone numbers.

> *The NGO Mobile Dental Service was just here for 2 weeks out of my 5 weeks stay. They put up notices in the pharmacy window and shop windows and advertised in the 'Town H Community Forum Magazine" They were very busy, and we had a few patients come to the pharmacy and I gave them the 1800 number on the shop window. (Pharmacist 10)*

> *The truck staff talk to the hospital admin more than to me. We just know when they are coming. They ring to notify us of when they are coming. The NGO Mobile Dental Service send us posters and stuff to let us know when they are coming about a month prior to them coming. As soon as the community is aware that the dentist will be in town they ring, and we give them a number and then they ring and book for the NGO Mobile Dental Service or for the dentist her they get an appointment. (Nurse Unit Manager 2)*

Building Community Oral Health Awareness: One of the problems reported by participants faced by oral health services such as the NGO MDS in remote areas, was the lack understanding for the importance of good oral health. One participant described the relationship between oral and medical health to be poorly understood by many people and encouraged proper building of this awareness.

> *I think that they just breed them tough because they know that they can't just get to the dentist and people just aren't as pro-active about their health and particularly their dental health. (Dental Practice Manager)*

The goodwill described by one dental practitioner associated with the NGO MDS meant that the service was starting to be widely accepted, the longer it was in operation, and it was suggested that more residents were becoming aware of the free service and as a consequence, were being made more aware of the importance of oral health.

> *The impact of the NGO mobile dental unit has been awesome. When you get to a new town, only the brave will come first and then word spreads such as "they're awesome, they do this, this and this. They don't hurt" Once this word spreads then you get all those others who are a little bit afraid and they will come. They then tell everyone, "yes they are awesome, and they are fantastic". And don't just treat one problem, we do hygiene instruction as well, so we have seen a change with a lot of the kids now out this way. They have now got toothbrushes and are brushing their teeth every day, so they are not getting the holes like they used to. (Dental Assistant 2)*

> *People are very happy and are starting to rely on the truck. It is free and they like that too. (Pharmacist 10 Town H)*

There have been some examples of Indigenous-specific barriers to keeping dental appointments. Participants described the importance of addressing cultural awareness as a strategy to increase oral health awareness in Indigenous communities.

> *In some of our communities, particularly the Indigenous communities we have a lot of "fail to attend appointments". The rate per visit might be that we have 16 "fail to attend". Our worst example was an outreach centre in the North West and so we worked very closely with the DON and said that we needed to promote the importance of the service and obviously that those people on the list need to come in, and if they can't make it then making sure they ring up and cancel that appointment. We have seen those numbers drastically decrease by doing that. (Dental Practice Manager)*

Preventative oral health care provision: The dental personnel from the NGO MDS reported that increasing the amount of preventative oral health care offered would be one of the most effective strategies to improve the oral health of rural and remote Queenslanders. They suggested that once the cycle of providing mainly emergency dentistry was slowed, patients would be able to prevent dental caries by learning effective oral hygiene procedures and engaging in regular dental check-ups.

> *We want to move The NGO Mobile Dental Service, more to preventative treatments and so we want to possibly increase those numbers with people just coming in for a check-up and so they are quicker procedures and we are not needing to do fillings and pull teeth out. So,*

> *the dental assistant generally does a bit of follow up when they come out of their appointment and the dentists also take a roll in their preventative education. The preventative stuff is key. If that was done to a professional enough standard, then there would be no need for us to do such acute intervention. The value of those types of activities would be amazing you know financially as well as everything else. (Dental Practice Manager)*

Dental practitioners on the NGO MDS described the huge volume of curative dental care required in rural and remote Queensland communities and fully endorsed the strategy of increasingly prioritising preventative oral health care.

> *We do a lot of cleaning and scaling and polishing of teeth. We try to focus on the importance of giving the patient the information they need for the long term. We just don't do preventative, we do curative as well. So, in that forty-five minutes I will do a check-up and do x-rays and if I diagnose, I get consent and I inject there and then and then I'll do a clean and four, five or six fillings all in that forty-five minutes and then I'll do the next patient. (Dental Practitioner 7)*

> *Especially this year, we have seen a lot more exams and check-ups, you know that yearly check-up that everyone should have. That is starting to take shape now and we are getting on top of that really acute phase. Queensland Health are doing a fair bit of it now regularly also. So, it is the working between the two services that seems to be helping. You can definitely see that the amount of acute and chronic dental problems is decreasing. (Dental Assistant 2)*

> *The truck was good for health care card holder and private patients but couldn't get in for a check-up…emergency treatments only. (Pharmacist 9)*

Diet instruction: A participant from the NGO MDS described the necessity to include diet instruction in dental appointments to teach its inter-relationship with tooth decay. They reported that bottled water was an expensive item to buy and because some of the water in central Queensland was artesian bore water, which was often undrinkable, the consequence was that people often drink Coca Cola and soft drinks instead.

> *Ok their diets are still haven't changed, they are still drinking Coke and there are lollies everywhere you go. In one outreach centre, you can't even touch the water you have got to get bottled water out here and it is cheaper to buy coke than it is to buy water. That probably has a lot to do with the decay rate out here. The first year we came out here it*

was amazing how many nine and ten year old's, would be walking down the road carrying two litre bottles of coke. (Dental Assistant 2)

Toothbrush provision: A common recurring theme from Case Studies 1 and 2 was also raised by some of the participants from the NGO MDS. This participant encouraged cheaper pricing for toothbrushes in rural and remote Queensland to make them more affordable for low income earners. Due to large transport distances, some of the retail outlets have a monopoly on toothbrush types, head sizes, and costs.

Supply decent toothbrushes at a reasonable price so that people can afford to buy them, and you know if you go into a supermarket now and they are all massive heads. I can't get one of those in my mouth. (Dental Assistant 2)

Water Fluoridation: One participant discussed the fact that fluoride occurred naturally in a lot of the bore water drunk by rural and remote residents, and consequently the decay rate may be lower in some individuals from far Western Queensland properties where fluoride levels may be optimal. This participant recommended water fluoridation either naturally or introduced into rural and remote town water supplies.

It is amazing but the further West you get, and I don't know whether it is diet or lifestyle or whatever, but it is amazing how many elderly people still have the natural dentition. Especially in comparison to the elderly people in towns and cities. A lot of the towns from Blackall out, are bore water or artesian water and I have no idea what the fluoride content is in that water? (Dental Assistant 2)

4.3.3.5.2 *Better service provision*

Improving service provision by the NGO MDS was suggested as a strategy to improve oral health in the communities studied. Participants supported increasing the accessibility to the NGO MDS and establishing funding reliability.

The truck comes once a year. The truck was here in June and they were flat out. They parked in the hospital grounds for two weeks. They had one dentist on for one week and then he flew out and a different one and a different driver flew in for the second week. (Medical Practice Manager 6)

The NGO van is excellent and should continue. When the dentists are free, they will visit but if have to pay then won't go. Comes twice a year but would be better to come every three months and stay for a week. The waiting list is very long for truck, so some patients

> *followed the truck to an outreach centre where it was not as busy and got treatment done. This is the second visit out here it has made. (Medical Practice Manager 5)*

The Service provision provided by the NGO MDS was described by one participant as a fly-in fly-out service

> *That's basically what the NGO Mobile Dental Service is, (a fly-in fly-out dental service) they come in for a couple of weeks twice a year and then they go. So, most of the dental needs of the community are being met. (Nurse Unit Manager 3)*

***Increase accessibility to dental services*:** Many areas in Central Queensland did not have access to government or private dental practitioners and the NGO MDS helped fill that gap by increasing the community accessibility to dental care. Four ways to further improve access were: providing transport for the patient to the mobile dental service, improving road conditions in rural and remote Queensland, improving telecommunication networks and, improving power supplies in rural and remote communities.

Provide transportation for the patient to the NGO MDS: Some participants gave examples of situations where transport for patients was organised to those hub communities where the truck was positioned.

> *As much as Queensland Health say they are a state-wide service we hope to continue to provide care to those pockets that miss out. We try to pick a larger community that is centralised. So, our advertising goes out to the surrounding communities and the locals know they can travel in to the truck. Some of the councils put on a shuttle bus, but we have only had this in a couple of communities so otherwise it is just people bringing their cars in and driving themselves. I negotiate that shuttle bus with the council and it is usually in the smaller towns and sometimes it is the community Returned and Services League of Australia (RSL) that we can tap into that. (Dental Practice Manager)*

> *The NGO Mobile Dental Service doesn't come to large regional centres but when it was in Town G we had a busload of people that travelled there to be seen by them. (Nurse Unit Manager 1)*

> *The patients get a little minibus down and the HACC (Home and Community Care) team organise this. We parked in the centre of a small town once because the hospital was two km out of town and a lot of the people there don't have vehicles, or they are not road worthy and they can't drive them. But because we were in town and the Medicare Local girls were so "on the ball" they were able to pick up all the people and bring them to us for*

an appointment. So, we do work in with the communities where they are wanting and willing to do that. (Dental Assistant 2)

***Improve rural and remote telecommunication networks and power supplies**:* Many small communities in rural and remote Queensland have limited power supplies and poor tele-communication networks which make it difficult for the NGO MDS to operate successfully.

We need access to a 3-phase power supply also. We have a generator on board, but I don't like working under a generator because it gets hot under my feet. So, we don't like running off the generator. We also need more or less level ground. (Dental Practitioner 7)

Establish funding reliability: The NGO MDS operates under the continual threat that funding may end. Dental personnel reported that they were reliant on the continued financial support from the Foundation, a non-government organisation and the Queensland government.

We also do work under a finite budget, so much as we are so fortunate to have the private mining company provide the funding for us, there is a bucket (a set amount) that we can work towards. (Dental Practice Manager)

4.3.3.5.3 *Increasing the NGO MDS Workforce*

The suggestion to increase the number of NGO MDS, or developing a fly-in fly-out model, was described by participants as a strategy to improve oral health care provision in rural and remote Queensland. The NGO MDS employed private dental practitioners who had no restrictions on their rights to treat either private or public patients.

We would love to expand the service and so we are questioning if that means the development of another truck which would follow on six months later so that the dentist could be visiting twice a year to those communities until we can get them to what we would consider to be a preventative stage or go to new communities and keep going. Or developing a fly-in fly-out model like we do with our doctors and nurses and go out to Queensland Health facilities that might have a dental chair that is not used. (Dental Practice Manager)

The truck is a wonderful thing and we need more of this sort of service out in the bush. (Director of Nursing 5)

Put government money into more mobile units for dentists like the NGO Mobile Dental Service and make it free. (Medical Practice Manager 5)

However, not all participants were eager to increase the number of NGO MDS mobile dental units, due to economic competition with existing dental practitioners who supplied oral health care to residents from this region.

> *I don't like the idea of too many NGO type services giving out free treatments to everyone because that will undermine my practice. At the moment, I am reasonably stable, but you don't want to get too many dentists out here without first working out demand for service. I am happy to treat anyone of course but maybe the working poor should be the targeted dental patients for NGO Mobile Dental Unit. (Private Dentist 4)*

The advantages and disadvantages of employing the services of three different types of dental practitioner: new dental graduates, older more experienced dentists or dental auxiliaries, was explored. The question asked was whether new dental graduates, older more experience dental practitioners or dental auxiliaries were more suited to practice onboard the NGO MDS truck. The dental practitioners on board the NGO MDS acknowledged that they require a certain skill set to be able to work effectively in the continually changing work environments faced. Other dental personnel from the NGO MDS also agreed that new dental graduates were inexperienced in the complicated oral surgery and specific anaesthetic techniques that were often required.

> *We had a contract with the Voluntary Dental Graduate Year program [Author note- now no longer operational] to have new graduates and they came on board. They would not have even remotely been able to do the work and I feel for some of them because they get dumped in some of these government clinics completely by themselves. It's a problem and unfortunately the rural patients are the guinea pigs for these new graduates. Unfortunately, I don't have a lot of trust in how they train these people. For instance, they are not trained in giving a posterior, superior alveolar block. (Dental Practitioner 7)*

Experienced dental personnel from the NGO MDS believed that dental practitioners need at least 10 years of generalised dental practice to learn all the skills necessary to be able to practice alone in rural and remote Queensland.

> *You have to be good at everything out here because there is no back up. New graduates can "fill and drill" pardon the pun, that's pretty basic, but it's the extraction side of things that is the challenge. They don't seem to do a lot of the really complicated stuff now days in Uni. They don't teach them how to suture and so there is an added pressure on your full time other dentist to mentor them. So, if the new graduate is really good then it works but if they only have a little bit of experience then it's not so good. I have seen students and I have seen new graduates, I've seen fourth year outs and 15, 17 and 30-year outs. The*

> *difference is that from the 10-year mark onwards, it's huge as long as they have had that grounding. You know like if you get a new graduate, they have only done text book stuff. Even some graduated don't even know how to talk to patients. (Dental Assistant 2)*

Dental personnel from the NGO MDS described older experienced dental practitioners as better able to cope with the stresses associated with these emergency dental presentations, as they have had the chance to learn all the facets of dental practice and were now happy to draw on those skills and experiences to provide quality, reliable dental care.

> *You need quite a lot of expertise to manage that type and level of treatment. (Dental Practitioner 8)*

Other dental care providers such as dental therapists, hygienists and technicians were explored by some participants as an effective alternative to employing dental practitioners. However, space limitations on board the NGO MDS truck were described as making it more sensible to employ two dental practitioners rather than one dentist and a dental auxiliary. The dentist was considered by participants to be a more comprehensive dental provider as they can perform all dental procedures. Participants thought that as the NGO MDS receives more funding, or more trucks were established, the strategy of employing dental auxiliaries may be realised.

> *But having two dentists and not a hygienist or therapist is really viable because they can do the whole gambit and not just part of the treatment. I know that the original plan was to be a dentist and a hygienist. The dentist would do the adults and the hygienist would do the children but you kind of need two dentist and very qualified ones at that because it's not easy stuff out here. (Dental Assistant 2)*

> *Having dental hygienists is great when you can get them. We have thought about employing a dental hygienist, but it is just that we are restricted by space limitations. If we had space for a third clinic, we would put that on board. (Dental Practice Manager)*

4.3.3.5.4 *Upskilling non-dental primary health providers to provide adjunct oral health care*

The results from this third case study aligned with the findings from Case studies 1 and 2, in which participants from the non-dental primary care network in the new community Town H showed an interest in further education for emergency dental techniques.

> *I am not very confident in providing dental advice. I would mostly advise the patient to see a dentist and I would provide short-term pain relief. I would be very interested in further*

> *education in dental emergency stuff like how to put a tooth back in when it has been knocked out. (Pharmacist 10)*

The Director of Nursing for Town H also expressed interest in post graduate education in emergency dental techniques for hospital nursing staff and General Medical Practitioners, and it was suggested that an online education program or two-day course with the appropriate accreditation, would be the most favourable format. This was congruent with results from Case Studies 1 and 2. This non-dental participant described the limited oral health care knowledge resources available. One resource was as a dental chapter in the "Primary Clinical Care Manual". She described an oral health program that was promoted in the past called "Lift the Lip", which encouraged oral health checks by non-dental care providers.

> *You still could do some more education with nurses for example in the rural areas. We have education about everything really. We get a lot of education and if you targeted the rural nurses and made it something, they could attend even over a few days on how to deal with dental emergencies, they could even do it on line. There are lots of ways to provide education to nurses these days and medical also, doctors could do it. Upskilling the existing primary care network is a good start and even if we can give them some type of formalised accreditation for that extra education? Maybe that will be an incentive? You know maybe a yearly upskill or something? Do you know about the "lift the lip" program? We have our little bible "The Primary Clinical Care Manual" and that is great but being able to speak to someone over the phone would be great. (Director of Nursing 4)*

The further question asked in this case study was the impact this lack of oral health care knowledge had on interprofessional collaborations between dental personnel on the NGO MDS truck and members of the non-dental primary care networks in the communities. Dental personnel from the NGO MDS described instances of medical practitioners' lack of dental knowledge and the impact this had on patient care.

> *Doctors don't have any understanding of dentistry at all. I have spoken to a lot of doctors over the years and their training in dental problems is weak. That's why they tell the patients to take antibiotics for a week and then go and see a dentist. They don't have any further knowledge. You can ask them which tooth is what, and they don't have any clue. They don't know how many roots the tooth has or where the tooth is located. When I was working in the hospital in theatre and associating with doctors all the time, they would have no idea of the tooth numbering system. Speaking the same dental language would be a good start at least. So back to basics first, you know even if they could say "upper left first*

> *pre-molar" or something like that it would help. Then if they could work out if it was decay, abscessing or just gums bleeding. If a patient complains of bleeding gums, then the doctors could tell them it's because they are not brushing or flossing. Even the doctors could teach people how to floss if their gums are bleeding. That is probably the biggest thing that they could do apart from acute care. (Dental Assistant 2)*

A dental practitioner from the NGO MDS described the basic emergency dental training that medical practitioners received in his country of origin, before they were placed on rural practice rotations.

> *Well I can tell you what happened in the country where I was medically trained for instance. The doctors did some training as far as extractions go. I was in the forces as well and a friend of mine was a medic and he got posted to a weather station and he was trained to do extractions and basic dentistry. That's the only feasible thing to do is to provide education. (Dental Practitioner 7)*

Upskilling pharmacists in oral hygiene instruction, post-operative care and oral health product selection, was suggested by the dental personnel from the NGO MDS as a strategy to adjunct patient care, after they leave the communities.

> *Even if we could teach the pharmacists how to floss and they could teach the patients how to floss. Pharmacists should stock more dental products like disclosing tablets for the kids. Prevention is always better than cure. Even the pharmacy assistants wouldn't have a clue about how to use a piece of floss or even what it looks like. With the amount of people going overseas now for bridges and they don't get that post op care and have never been taught to use super floss. The pharmacist could perhaps help these patients by educating them. (Dental Assistant 2)*

4.3.4 Summary

The impact that the NGO MDS had on the oral health of the four communities studied was examined and reported in this third section of this results chapter. The three communities from Case Study 2 and the data from participants from Case Study 1, were re-examined in relation to their experiences of the NGO MDS. One more community was added from a new Queensland region to ensure data analysis triangulation. All four communities accessed oral health care from the annual visits from the NGO MDS as well as from intermittent visits from government dental practitioners and school dental services, fly-in fly-out private dental practitioners and by visiting dental practitioners from neighbouring communities.

Four main themes emerged and were explored within the collective data set, these were the challenges to effective oral health care provision by the NGO MDS, communication and referral pathways, strategies to improve oral health provision by the NGO MDS, and the interest shown in introducing dental technologies to medical practices to manage dental presentations. Within these themes were many subthemes that when combined developed a snapshot of the situation in relation to the oral health care service provided by the NGO MDS to these four communities.

There were seven major challenges to effective oral health care delivery faced by the free mobile dental service: limited treatment option choices and types of oral health presentations, travel and cost, logistical issues, competition with local dentists, rural dental workforce shortages, funding uncertainty and, exploitation of the system. Oral health problems were often serious in nature and challenges due to limitations in treatment options were reported. Time constraints and lack of dental technician back up for complicated dental procedures impacted on the types of dental care that could be offered creating a distinction between emergency and comprehensive dentistry.

Some patients were reported to encounter difficulties when accessing the oral health care available due to the expense of travel and associated costs in time off work, and some residents had to follow the truck to complete treatments due to the short duration of its community visits. Logistical challenges unique to the NGO MDS, often meant that the 18-wheeler semi- trailer truck faced poor road conditions making access difficult and some areas poor amenities such as phone coverage and internet access impacted on appointment making and access to patient records.

The social impacts of this free mobile dental service on peoples' lives were explored. The lack of oral health awareness of many residents in the communities studied was observed by dental personnel from the community. The social impacts of poor oral health observed in Case Study 2 of this research project were exacerbated by issues specific to patient's accessing the NGO MDS such as: poor patient compliance and ambivalence to keeping scheduled appointment times, time required off work to travel to the service, mental anguish experienced because of limited treatment availabilities, fear of dental procedures and, concerns about the lack of continuity of care.

Occasional professional competition with existing private and government dental practitioners was reported as a challenge faced by the NGO MDS. Funding uncertainties for the NGO MDS meant that sometimes residents were reluctant to form relationships with the mobile clinicians, and they chose to support those resident dentists in nearby towns or existing fly-in fly-out dentists. The dental personnel on board the truck were also conscious of creating patient dependence on the service due to the uncertainty of service continuation and some examples were presented of instances where the NGO MDS was exploited by patients.

Communication and referral pathways were explored to examine the relationships that dental personnel on the NGO MDS had with General Medical Practitioners, pharmacists, Directors of Nursing , other allied health care providers, hospital administration staff and non-medical professionals. The most effective communications occurred with Directors of Nursing, hospital administration staff and nurses because these people were often instrumental in the logistical planning of visits by the NGO MDS. They organised keys to bathrooms and access to gates of hospitals, as well as notifications to patients of arrival times for the free dental service. Interprofessional communications with General Medical Practitioners and pharmacists were reported by the NGO MDS personnel to be poor to non-existent.

Relationships with existing rural dental practitioners, both government employed and in private practice, were explored. Interprofessional collaborations were more evident with government dental clinicians due to collaborations with Queensland Dental Health Departments but relationships with private dental practitioners were poor.

Two-way referral pathways between the rural primary care network and the NGO MDS and the notification processes for the impending arrival of the NGO MDS were explored. The results showed very little evidence of formalised referral processes but the notification of arrival time for the truck acted as a signal to refer patients to the service. The physical presence of the 18-wheeler semi-trailer truck was reported to encourage curiosity and oral health awareness in communities, and dental personnel reported subsequent positive effects on oral health promotion and on community building.

Strategies to improve oral health provision by the NGO MDS were examined. The most common suggestion by participants from this case study was to increase oral health promotion. Increased advertising and promoting the NGO MDS were suggested to build community oral health awareness. Highlighting the importance of preventative oral health care and the significance of dental caries and diet, were suggested by participants to increase this awareness. Promoting the benefits of water fluoridation was suggested and increasing access to reasonably priced toothbrushes was endorsed.

Improved service provision by the NGO MDS was described as an important strategy to improve oral health care provision throughout rural Queensland. Increasing accessibility for patients, by providing transportation to central parking hub locations that are easily accessible for the 18-wheeler semi-trailer truck, would offer better oral health services to residents. Establishing funding reliability would enable trust building by communities as to the continuation of the NGO MDS. It was suggested by some participants that increasing the number of mobile dental units might be an option for increased service provision in the future.

Methods of attracting dental practitioners, preferably experienced clinicians rather than new graduates, were explored as strategies to increase the dental workforce required for sustainable oral health care provision in the bush. Dental auxiliary care providers such as dental therapists, dental hygienists, dental technicians, and dental assistants, were reported to be also needed in these rural areas.

Finally, the interest in the education and upskilling for the members of the primary health networks in basic dental emergency triaging and care, was explored, to better utilise existing members of the primary health care team when oral health care professionals were absent. It was suggested by participants that the development of better interprofessional communications between oral health care providers such as those on the NGO MDS, and medical care providers, would improve patient outcomes and examples were presented where post-operative oral health care by medical staff might have benefited patients when the truck moved on to its next location.

The NGO MDS was reported as providing an effective free dental service around rural and remote Queensland. The many factors effecting this dental service and its continuation were reported in this third section of the results chapter. There were many positive outcomes from this delivery system for oral health care in rural Queensland but there were also some problems associated with the continuation of this charitable service.

The interest in teledentistry and teleconferencing were examined as a way for the NGO MDS to enhance interprofessional communications with the rural primary care networks. The dental personnel showed some interest in the utilisation of these technologies, similar to the results shown in Case Studies 1 and 2 of this research project, however the unreliability of internet broad band capacity in rural and remote Queensland was reported to pose a major barrier to the acceptance of the technology.

Three different models of oral health care delivery were reported in this results chapter. All three case studies reported similar findings in relation to the barriers to good oral health in the communities examined. Strategies to improve the situation were also reported and there were some similar strategies reported across the three case studies. However some of the strategies were specific to each different model of oral health care delivery. The differences reported were in the interprofessional communication questions. Case Study 1 with its “central referral centre “ reported instances where phone messages were left by the rural primary care network to the call centre and were never returned. The interprofessional communication was non-existent and this created frustrations with this model of oral health care delivery. The oral health care delivery model in Case Study 2 employed a new graduate dentist who was situated in a centrally located government dental

clinic. This model allowed the primary care network to speak directly with the dental practitioner for advice and allowed the non-dental health care providers to ensure that an appointment was made with the dental practitioner. This improved patient outcomes and interprofessional collaborations were possible. Difficulties were still reported however because patients still needed to travel long distances to receive dental treatments which was often impossible. Case Study 3 reported a different type of oral health care model. This delivery service took the dental service directly to the community. The advantages and disadvantages of this service were reported, and the three case studies will be discussed for their efficiency in chapter 5.

Chapter Five: Discussion

"Knowledge is a process of piling up facts; wisdom lies in their simplification."

Martin Fischer, "A Continuing Anthology" (March 1945) edited by Smith Dent, "Fischerisms" p. 309

The previous chapter presented the results from three different models of oral health care service delivery that emerged from an investigation of eight selected rural and remote Queensland communities. A descriptive qualitative case study approach with semi-structured interviews was employed. Individual face-to-face and telephone interviews were conducted with 67 non-dental and dental health care provider participants from these communities. Many of the 55 non-dental primary care providers were resident in the community, either long term or on short term locum basis. The twelve dental participants were not resident in the communities examined but had experience of treating patients from these eight communities. They were a combination of fly-in fly-out dental personnel, regional oral health care providers, or dental practitioners located in surrounding larger communities.

The aim of this study is to describe the situation in relation to oral health care provision in rural and remote Queensland and to report the barriers to good oral health and the strategies suggested by the serving primary and dental care practitioners to improve the provision of oral health services to their communities.

In this chapter, an overdraft of the oral health status, reported by participants in their communities is presented. Results for each separate research question are discussed in relation to the participant response and the body of knowledge in the existing literature. The similarities and differences between these two sources are discussed. The conceptual framework which underpins this study will be reviewed and modified in line with the findings.

The answers from participants to the four main research questions are discussed. These questions are:

RQ1: What are the barriers and challenges to effective oral health care provision and access in rural and remote communities in Queensland?

RQ2: What is the relationship that exists between dental practitioners and the non-dental primary care network

RQ3: What strategies have been suggested to improve oral health in the rural and remote regions examined*?*

RQ4: What is the level of interest in the use of technology by non-dental practitioners and dental practitioners in the management of dental problems?

5.1 Oral Health in the eight rural and remote Queensland communities

Non-dental primary care providers including General Medical Practitioners, pharmacists, nurses, speech pathologists and Indigenous health workers, in the eight Queensland communities often noticed poor oral health in their patients. This is supported by findings from the National Advisory Council on Dental Health in 2012 indicating that oral health is worse in rural and remote residents than in regional centres (National Advisory Council on Dental Health, 2012) and that children from Queensland and from the Northern Territory have the highest severity of tooth decay in Australia (Do & Spencer, 2014).

Non-dental primary care provider participants in this study described how residents often presented to local hospitals, medical practices, pharmacies and Indigenous Health Care Centres, with a wide range of oral health problems varying in severity from painful dental abscesses with facial swelling, to toothaches, lost fillings, dental trauma or requests for oral health care advice. As evidenced elsewhere in the literature, in the absence of a resident dentist or with only infrequent visiting dental services, people with dental problems often present to medical practices (Cohen et al., 2011), local hospitals (Cohen et al., 2008), pharmacies (Maunder & Landes, 2005) and Indigenous Health Centres (Tennant & Kruger, 2013) with a range of oral health problems. Primary care providers from all eight communities described examples of oral health presentations from patients in differing financial situations, that is whether they had Health Care Cards, private dental insurance or those with no dental health care cover at all. This finding is supported in the literature suggesting consideration for the overlap in the mechanisms of oral health care service delivery needs by public dental services and private health insurance (Crocombe et al., 2012; Crocombe et al., 2013; Teusner et al., 2013).

5.2 Research Question 1

To address the first research question, participants were asked questions to determine what they thought were the barriers and challenges were to effective oral health care provision and access in their community. The answers to this question will be discussed by examining the common

challenges faced across all eight communities. The challenges will then be discussed from the perspectives of: non-dental primary care providers and dental personnel. The specific challenges faced by the three case studies examining three different oral health care delivery model case studies, is then discussed.

5.2.1 Challenges to effective oral health care provision and access across all eight rural and remote Queensland communities

Challenges to effective oral health care provision included dental workforce shortages, the high costs of dental treatments in terms of travel and time off work and the relatively high cost of dental treatment itself, and the lack of oral health care awareness of residents for the importance of good oral health.

5.2.1.1 *Dental workforce shortages*

Dental workforce shortages in rural areas affected all of the three models of oral health care provision examined (government dental care, private dental practice and philanthropic services). Dental practitioners and other types of oral health care practitioners, such as oral health therapists and dental hygienists, were all reported by participants to be in short supply, causing government facilities in the districts examined to be universally short staffed. This finding is consistent with literature indicating the unequal distribution of dental practitioners across Australia. More than three times as many dentists practice in regional areas than in rural and remote areas (Health Workforce Australia, 2014). The dental participants interviewed in this research project reported generalised shortages of trained dental assistants, which affected all government, private and philanthropic oral health care services from the eight communities examined. This is also supported in the literature by a report from Perth (WA) indicating the chronic shortage of trained dental assistants, which has restricted the abilities of some dental practitioners in that state, to work effectively (Buck, 2011).

The factors reported in the data collected that affect the dental workforce shortages are lifestyle factors such as inadequate accommodation, poor schooling facilities, lack of cultural activities, large distances to family support networks and to spouses, lower remuneration incomes due to lower patient population bases, and the greater expenses involved when working in rural than metropolitan areas. Other studies have also reported similar findings (Godwin et al., 2016; Godwin et al., 2014) influencing factors that discourage dental practitioners from practicing in rural and remote communities. The professional isolation faced by colleagues described in another study of dental practitioners (Bauer & Brown, 2001) was also expressed as a concern. However, other studies found that the utilisation of online dental forums by the younger technical-savvy graduates

alleviated this issue to a degree (Gray, 2016; Handal et al., 2010). The difficulties associated with accessing dental laboratories to enable the construction of dental appliances such as dentures, dental crowns and bridges were reported by dental participants from these studies as specific disadvantages faced by dental practitioners taking up practice in remote areas.

5.2.1.2 *Relative costs of dental treatments*

Affordability, especially for those from lower socioeconomic backgrounds, is one of the barriers which can prevent people from accessing dental care (Chrisopoulos et al., 2016). The members of the primary care networks examined in this study described the high cost of patients travelling to access the oral health services, the associated costs of the dental treatment itself, and the time needed off work to access this care, as substantial barriers for residents in rural and remote areas to access timely dental care. These findings are supported by previous literature that reports the need for rural and remote people to travel to larger population centres to access dental services and the additional costs associated with this travel, including time off work (Carter & Stewart, 2003; Wong & Regan, 2009), arranging alternative care for dependents, and return visits to the dentist for optimal treatment (Curtis et al., 2007).

5.2.1.3 *Lack of oral health awareness*

Dental personnel reported frustrations with the ambivalence of patients towards the importance of oral health maintenance, and lack of understanding of the interconnection between good oral health and overall medical health as evidenced in the literature (Critchlow, 2017; Hayashi et al., 2017; Liljestrand et al., 2016).

Both dental and non-dental participants, observed a lack of oral health knowledge in the community, especially among parents. It was reported that many families appeared to be unaware that they should be supervising the cleaning of their child's teeth until they were proficient, and both non-dental primary care providers and dental personnel emphasised the importance of educating people from an early age in schools and the community about oral health, 'regular check-ups' and preventive dental care (National Advisory Council on Dental Health, 2012).

General Medical Practitioners expressed concerns about seeing patients on return visits who had not attended appointments with dental practitioners as recommended during previous medical appointments. They were frustrated when some medical presentations that required hospitalisation, could have been prevented if the patients had sought dental treatment when first advised. They described the lack of oral health awareness and the low priority of good oral health for their patients. The previous literature indicates the importance of raising the oral health awareness of the population (Blinkhorn et al., 2012; Pacza et al., 2001; Slade et al., 2011). General Medical

Practitioners were aware of the need in their communities for promotion and oral health education opportunities, recognising the important role that existing health care professionals could play in providing oral health screening and education during regular patient interactions. They added their concerns about the high costs associated with seeking these treatments in relation to the travel distances, overnight accommodation and the dental treatments themselves, outweighing the patient's perceived benefits of seeking dental treatment. A similar finding was reported in a 2003 study which showed that people in remote communities avoid dental appointments due to large travel distances to access care (Carter & Stewart, 2003).

5.2.2 The challenges of poor oral health on people's lives

The National Oral Health Plan 2015-2024 highlighted the importance of oral health and the impact of oral disease on the physical and psycho-social wellbeing of people (Oral Health Monitoring Group, 2015). Good oral health is essential for overall medical health. Without a healthy mouth, people are unable to eat, sleep, or function comfortably at work or in social situations. People with missing teeth may feel uncomfortable and embarrassed which may contribute to self-esteem issues (National Advisory Council on Dental Health, 2012). The primary health care participants described the significant psycho-social impacts that poor oral health have on the quality of lives of their patients. This finding is supported by earlier studies which also found that poor oral health contributed to the incidence of depression (Cohen et al., 2007). The National Oral Health Plan 2015-2024 established the importance of oral health and the effects that poor oral health has on people (Oral Health Monitoring Group, 2015). This oral health plan also recognised that some rural and remote residents with low socioeconomic status and poor education levels may often not seek timely oral health care.

Some members of the primary care networks from the communities studied reported the psycho-social effects of poor oral health on their patients. Participants from the eight communities described the lack of self-esteem they had observed in their patients, with unsightly dental appearances, and the mental anguish associated with toothache and the inability to seek timely oral health care. A systematic review of the literature in 2010 demonstrated similar findings where the impact on quality of life was directly related to tooth loss (Gerritsen et al., 2010). The fear that patients had of the impending dental procedures themselves was also reported by members of the rural primary care networks to cause psychological issues which contributed to poor mental health. Worrying about financial inadequacies for accessing oral health care in relation to the costs of dental procedures themselves, as well as the time off work that is needed to travel the long distances to access dental care, also impacted the emotional well-being of residents. The National Dental Telephone Interview Survey in 2002 reported similar findings in relation to financial concerns when

taking time off work to seek oral health care (Carter & Stewart, 2003). The effects on family members, especially children who could not be left alone at home, and hence needed to also travel large distances with their parents so the latter could access care, was an issue. Participants from the rural primary care networks in this study reported many instances of children in their communities with poor oral health and the despondency of some parents in actively addressing their children's oral health needs.

5.2.3 The challenges for the management of oral health issues by non-dental primary care providers

The treatments and advice provided by the primary care providers from all of these Queensland communities commonly included short-term pain relief, antibiotics and advice to see a dentist. This accords with the literature that suggests that most non-dental primary care providers refer a patient to the dentist and only provide temporary palliative relief (Cohen et al., 2011).The rural primary care network participants described the challenges of many instances of repeat presentations by the same patients who did not attend to dental referrals. As previously discussed, they mentioned the lack of prioritisation given by patients to oral health, and the poor understanding of the interconnection between oral and overall medical health. This has been evidenced in the literature with patients opting for self-care strategies rather than getting professional oral health care (Cohen, Akin, et al., 2009).

The findings from this study suggest that primary care providers commonly provide only limited management for dental presentations which is consistent with the literature suggesting that General Medical Practitioners only provide temporary treatment for dental problems (Cohen et al., 2011; Cohen et al., 2008). In many instances the option available to General Medical Practitioners from this study was to hospitalise the patient if the infection was severe. This is supported by the literature that reports that more patients from remote areas (10.09 per 1000 population) than metropolitan areas (2.69 per 1000) are hospitalised for medical conditions of dental origin (Kruger & Tennant, 2015). This situation challenges the limited hospital bed space available in rural and remote hospitals and is corroborated by a study from the USA that suggests that low-acuity patients should spend less time occupying an Emergency Department bed to reserve limited bed space for the sickest patients (Stauber, 2013).

Participants from the primary care networks in the eight communities examined described challenges relating to differing levels of confidence in providing oral health care advice and treatments. The results from the data show that personal experience and post-graduation education levels are major factors in confidence levels when giving oral health care advice to patients in the

absence of a resident rural dental practitioner. Primary care providers acknowledged that they were not always confident in providing oral health advice due to the lack of training. They described very limited exposure to emergency dental management training during their university education. Previous literature supports these findings that health care providers are keen to learn more about oral health. (Cohen, Akin, et al., 2009; Hocker et al., 2012; McCormick et al., 2013).

5.2.4 Challenges to effective oral health care provision by Dental Practitioners

Oral health care is delivered to the eight communities examined in several ways: government oral health services, which were accessible by eligible patients with a Health Care Card, private oral health services for those residents who did not have a Health Care Card, a philanthropic mobile dental unit delivering services to all residents regardless of Health Care Card or economic status, and by sporadic School Dental and Indigenous Health Care Services.

There were two distinctive types of dentistry delivered by the dental practitioners servicing rural and remote communities: problem-based care and comprehensive dentistry. Problem- based emergency care dentistry alleviates immediate, acute pain and, in the eight communities studied, this was the most common form of oral health care provided by both the government dental clinics and the NGO Mobile Dental Service. The development of a risk adjustment model for the quality of oral health care was developed in 2003 and used tooth retention as an indicator of quality dental care (Gilbert et al., 2003; Jones et al., 2003). This type of tool can be used to identify the type of oral health care that a patient may have received.

Comprehensive dentistry considers the other functions of the oral environment such as masticatory function, occlusal and temporo-mandibular joint function, aesthetic dental restoration, speech function and preventative dental care (Giddon et al., 2017). The oral health care providers interviewed from the NGO Mobile Dental Service and the public dental services described limitations in the types of dental procedures they could offer due to funding and time restraints. A 2015 study from Tanzania, corroborated these findings by showing that comprehensive oral care delivery was dependant on the availability of dental materials and equipment, the skills of the practitioners, and the cost of services (Nyamuryekung'e et al., 2015).

Comprehensive oral health care has provision for high end procedures such as root canal therapies, crown and bridge therapies, implants and cobalt chrome dentures. These types of procedures were all more commonly provided by the private dental practitioners interviewed from this study, as they have access to high-end equipment, technical backup, private health fund remuneration for private dental patients and personal funding for comprehensive procedural work infrastructure.

The 2015-2024 suggests that oral health delivery services in regional and remote communities, must be flexible and innovative in nature (Oral Health Monitoring Group, 2015). The findings from this research show that the participants in the communities examined experience quite different mechanisms or oral health service delivery. The following section describes the challenges to effective oral health care provision by the different types of dental practitioners.

5.2.4.1 *Private Oral Health Care Delivery Models*

Three types of private dental practice delivery models were demonstrated in the eight communities examined: fly-in fly-out private practitioners, resident private dental practitioners in nearby hub rural centres and private practitioners in large regional capital cities.

5.2.4.1.1 *Fly-in fly-out (visiting) dental services*

A fly-in fly-out private dental practitioner servicing one of the Queensland communities studied had a large practice in a major regional centre and travelled to the remote community periodically to offer care. The challenges reported by this fly-in fly-out dental practitioner are multifactorial: the high costs associated with infra-structure set up, the financial losses that occurred when the surgery was not operational (when the dentist was absent), the expense to fly-in and out, and high accommodation costs. These costs all need to be recouped in fees charged, which increases the costs to patients who seek dental treatment in rural and remote communities. This finding is reported by previous literature in which other fly-in fly-out staff also commented that although this model allowed oral health services to be provided, albeit sporadically, there were challenges to this type of service model (Irons, 2001). The significant financial resources and the time commitment to organise visit dates, accommodation and transport requirements have been previously reported as further challenges (Campbell et al., 2015; Irons, 2001).

A challenges for both the fly-in fly-out practitioners themselves and the primary care providers, was the reduction in available time to develop professional relationships (Campbell et al., 2015). Often when a dentist leaves a community, they require their patients to have access to adequate post-operative oral health care. The co-operation of the primary care network through interprofessional collaboration with these dental practitioners would be of major benefit to those rural and remote patients requiring this type of backup care.

5.2.4.1.2 *Resident private dental practitioners in nearby rural hub centres*

Some dental practitioners from this study had made the commitment to these rural and remote communities by setting up private dental practices in nearby areas. They described having

embraced the particular lifestyle factors that these communities provided and had established homes, schooling arrangements for their children and recognised travel as an inevitable result of the isolation. These dental practitioners suffered professional isolation and needed to travel to regional centres for post graduate education conferences to maintain their continuing professional development obligations for registration with the Dental Board of Australia.

These practitioners expressed their frustrations with some of the funding schemes that exist in Australia. The Dental Relocation and Infrastructure Subsidy Scheme (DRISS) (Health Workforce Queensland, 2016) was seen as unfair to existing dental practitioners as it allowed new practitioners to set up practice in the same community without being cognisant of the insufficient patient base to make another private practice viable. These established practitioners felt that some addition available funding could be directed towards themselves to improve their facilities as they had proven their long-term commitments to those rural communities that they had been servicing sometimes for 20 years.

The introduction of the NGO Mobile Dental Service was also sometimes seen as an issue as this service was occasionally in competition for those same patients that travelled often large distances to their practices. Some private dental practitioners had welcomed the help from this service in past times when they were very busy. They were however, wary of this type of mobile dental service expanding, as the existing private dental practitioners relied on the size of the patient population in their surrounding regions to support the economic viability of their private practices.

5.2.4.1.3 *Private dental practitioners in capital cities*

Many residents from rural and remote communities incorporated dental and medical appointments in their holiday travels. Interviewed members from the Primary Care Networks themselves were often in this category, because they were not eligible to visit the government dental clinics as they did not hold Health Care Cards, and access to local private dental practices was either limited or non-existent. In addition to this issue, the operating hours for the rurally-placed private dental practitioners in the nearby hub communities rarely included “after hours” appointments. Consequently, participants reported that the members of the Primary Care Networks found it more convenient to visit the dentist when on holiday than to take time out from their working week to travel the often large distances to access private dental care from surrounding rural dental practitioners. These residents maintained their long-term relationships with their dental practitioners in capital cities whom they had developed rapport with over many years. These dental practitioners often gave “over the phone “advice when asked by those

patients who worked as part of the rural primary care network. These medical care providers then in turn imparted this advice to their patients in the absence of a resident dental practitioner.

5.2.4.2 *Indigenous oral health care services*

Indigenous services in the eight communities were sporadic. Participants reported that Indigenous patients commonly accessed oral health care services through public dental clinics in Case Study 1 and Case Study 2. The philanthropic mobile dental service in Case Study 3 offered free services to Indigenous people. Case Study 1 participants reported that intermittent Indigenous services were provided via a mobile van that visited and was in association with the Goondir Aboriginal and Torres Strait Islanders Corporations for Health Services (Goondir Health Services, 2018). This Indigenous health care service is an Aboriginal Community Controlled Health Service (ACCHS), which provides primary health care to the local Aboriginal and Torres Strait Islander communities in the South West of Queensland. At the time of the interviews this service was not operating an effective oral health care service but was in the process of exploring a dedicated oral health care centre in Town D. This has now been achieved with a surgery consisting of five dental chairs that are serviced by dental students from the University of Queensland on rural rotational placements (Bradfield, 2016).

The communities in the Case Study 2 received their Indigenous health services only through the government dental clinic. Indigenous oral health care services have separate funding arrangements and schemes, such as "Closing the Gap", to allow Indigenous peoples to access timely dental care (Queensland Health, 2018). Non-dental primary care providers from these communities, screen Indigenous people for oral health issues and refer them to Indigenous Health Care workers to arrange funding and transportation for oral health care.

The oral health care personnel from the NGO mobile dental service report the challenges in offering oral health care to Indigenous people. Participants describe Indigenous people's mistrust of the imposing nature of the large vehicle, and the cultural issues that often make it difficult for Indigenous people to comply with time restraints and dental appointment scheduling. The previous literature supports these finding and underlines similar cultural sensitivity issues (Freeman et al., 2014; Williams et al., 2011).

5.2.4.3 *Government/ Public Health Services*

The Commonwealth Government allocates funds to the individual State Governments to fund public dental care through the 2016 National Partnership Agreement (Lalloo & Kroon, 2016). People in possession of specific concession cards are eligible for government funded dental care. Participants reported the limitations in the type of oral health services that were provided by public dental hospital services. Literature corroborated these findings and reported that the type of services

available to adult patients in public dental clinics was usually limited to emergency dental care and general dental treatment (Queensland Government, 2013). According to the literature, the public dental clinics are mainly located within hospital grounds or in Community Centres (National Advisory Council on Dental Health, 2012), however in this study it was found that these public dental clinics were mostly located in the larger hub communities and not in the smaller rural and remote communities examined in this research project. There is no evidence in the literature for a mandate for a unified, specific model of public oral health care delivery in Queensland. This is evidenced by the results from this study that examined two different models of public oral health Government-funded dental services in Case Study 1 and Case Study 2. The Chief Executive Medical Officers for these different regions organised the service model arrangements for their Queensland districts. The reviewed literature reported that children in Queensland have a dedicated school dental service (Queensland Health Department, 2013), however, this service was understaffed at the time of interviews, and was unable to offer regular oral health services to the communities studied.

5.2.4.4 *NGO Mobile Dental Service*

Four of the communities examined received oral health services via the NGO Mobile Dental Service. This is a new model of oral health care delivery in Queensland and this model will be discussed in the next section in Case Study 3.

5.2.5 Specific challenges to effective oral health service provision by Case Study

The eight communities examined were divided into three case studies that each received a different model of oral health service delivery. Case Study 1 consisted of four communities: Town A, Town B, Town C and Town D. Case Study 2 consisted of three communities: Town E, Town F, and Town G. The first two case studies examined the oral health delivery models from the public government dental service. These two case studies differed in regard to the referral mechanism that the non-dental primary network followed to access oral health services for patients with dental issues. Both models employed dental practitioners working in government practice who have restrictions on who they can treat. To be eligible for treatment, the referred patients must possess a Health Care Card (National Advisory Council on Dental Health, 2012).

The third case study examined an NGO mobile oral health care service that travels throughout central rural and remote Queensland offering oral health care services to all people regardless of socio-economic status. The third case study re-examined Town E, Town F and Town G, for data relating to the NGO MDS and introduced a new community Town H.

5.2.5.1 *Challenges for Case Study 1*

In the first case study, a Central Referral Call Centre was established to triage incoming referrals. This call centre was manned by a receptionist/operator and in their absence an answering machine recorded the incoming calls. The potential of this service delivery model to be successful has been established in the literature as an organised centralisation of all referrals to one central location designed to simultaneously improve service quality and efficiency (Rohleder et al., 2013). However, a 2017 study on the efficacy of this type of model reported that those patients who were given a low-urgency rating were more likely to self-refer to hospital Emergency Departments (Tran et al., 2017). The number of presentations to hospital Emergency Departments for conditions of dental origin is an issue of concern for rural and remote Australia as they take up valuable hospital staffing resources (National Advisory Council on Dental Health, 2012).

The consensus from the primary care providers interviewed was that the system had serious flaws that made it highly ineffective and frustrating. Participants reported ineffective triaging from the call centre in relation to the seriousness of oral health referrals, with the inexperience and lack of oral health training of the call centre operator identified as a major contributing factor for the failure of this model. Fernandez in 2008, demonstrated the efficiency of a call centre when it was manned by fully trained dental personnel (Fernandez et al., 2008), and Horton in 2001 showed some evidence that non-dental staff may use a triage protocol effectively (Horton et al., 2001). However the study by Horton defined “effectively” as meaning that most of these patients were directed to dental practitioners' direct phone lines for advice. In this study, the lack of feedback from the Central Referral Call Centre in Case Study 1 was a major cause of concern. Participants reported never knowing if the referred patient presented for treatment at the public dental clinic which caused frustration for the primary health network participants interviewed. The literature reports that two-way directionality of referrals is effective in increasing the quality of interprofessional collaborative practice for better patient outcomes (Boynes et al., 2017).

This Central Referral Call Centre model in this first case study had great potential to be successful but lacked the “personal” touch that is so much a part of Queensland culture. The lack of an effective two-way referral system and feedback from the call centre to the referring providers, provided frustration downstream. The inexperience of the call centre operator to effectively triage dental appointments in order of urgency was described as an important drawback to the model.

To improve the efficiency of this model it would be necessary to employ an experienced person to answer the calls and to offer sensible triaging of appointments in relation to the urgency of the dental issue, as was substantiated in the study by Fernandez (Fernandez et al., 2008). The primary health network providers were frustrated with the necessity to often have to leave a message if the

phone was unmanned, as they often needed immediate advice for patients with dental emergencies. The solution would be to have a 24 hour on-call person, experienced in dental triage, to answer the phone to offer emergency dental care advice.

5.2.5.2 *Challenges for Case Study 2*

In the Case Study 2 a directly contactable recently graduated dental practitioner was based between two government dental clinics in the region. The challenges posed by dental workforce shortages were addressed in this second case study with the active recruitment of recent dental graduates from James Cook University, but this posed specific challenges such as: arranging suitable dental mentors, the lower levels of experience held by recent graduates and the difficulties associated with limitations of broader practice experience availability, isolation from professional peers and lifestyle factors. The findings were substantiated in the literature that suggests similar difficulties for other recently graduating practitioners (Barichello, 2005; Pethrick et al., 2017). The recent graduate dental practitioner in Case Study 2 offered oral health care from a centrally-located dental clinic attached to a small medical facility, and travelled to a larger hub community to practice for two days a week with the support of the mentoring private dental practitioner. The importance of the supportive role of a mentor for recent graduating practitioners has been established in the literature (Bailey et al., 2012).

The recent graduate government dentist at the time of this interview expressed frustrations with the professional development limitations of the constraints of government practice. Literature supports this finding and describes recent as requiring access to extensive experience of the many different facets of dental practice to cement their knowledge, and this may often not be available to them in government practice (Newton et al., 2011). The professional isolation reported by recent dental graduate in the second case study, was substantiated in the literature which suggested that this model of oral health care delivery may make it challenging for new graduate dental practitioners (Godwin et al., 2017).

The challenge for the residents in the second case study was that the government dental practitioner had a large region to cover and this resulted in long waiting lists. Long waiting lists in government practices throughout rural and remote regions have also been reported in other studies (National Advisory Council on Dental Health, 2012). The patients in Case Study 2 had large distances to travel to access oral health care from one of the two clinics. Challenges relating to the travel distance were reported and included the necessity to get time off work, pay for accommodation, arrange child care and pay for fuel. This was corroborated in the literature by a study which described similar indirect patient costs as a barrier to them seeking dental treatment (Curtis et al., 2007).

This model of service delivery allowed patients and referring practitioners to make direct contact with the government employed dental practitioner and speak personally to them over the telephone at any time for dental advice and to make appointments. The challenge for this model of care, was that the dental practitioner always had to be contactable. The literature reports that telephone consultations with General Medical Practitioners appear to reduce the number of surgery contacts and out-of-hours visits (Bunn et al., 2004). A previous study suggested that the majority of patients who called dental call centres got a second opinion by speaking directly to the dental practitioner rather than trusting the advice from a dental call centre receptionist (Niekusch et al., 2006). Another study suggested that the most effective on-call system was direct contact with an experienced dental practitioner over the phone 24/7, however, this was often not available due to limited availability and competence, especially outside of normal working hours (Alnaggar & Andersson, 2015).

5.2.5.3 *Challenges for Case Study 3*

The third case study explored the challenges and barriers that dental personnel onboard the NGO Mobile Dental Service (MDS) faced in relation to the successful delivery of oral health care. The NGO MDS offered services to Towns E, F, G and H but did not physically service any of the communities examined from Case Study 1 (Town A, B, C or D). However, some members of the primary care networks and the dental participants from the first case study were aware that the free mobile dental service was operating throughout Central Queensland and offered their opinions on this model of oral health care provision from previous experiences with the service.

It was during examination of this case study that barriers specific to oral health care provision by the free mobile dental service were highlighted. These included logistical issues relating to poor road conditions which made it difficult to access some remote regions and limitations in the types of oral health care options offered due to time restraints. Time restraints were the result of the mobile service moving every two weeks, which made the completion of complicated dental procedures impossible. Other barriers mentioned by participants were professional competition with existing dental practitioners in the region, exploitation of the system by opportunistic patients, continuation of funding uncertainties and the inability to offer continuity of patient care.

The literature supports these findings with evidence from mobile dental clinics in the Netherlands reporting similar limitations to remote access such as the dependency of these clinics on an electricity supply, meaning that the service is not completely self-sufficient (de Baat et al., 1993). Mobile dental equipment is often costlier than the types found in fixed dental clinics and are generally more susceptible to mechanical difficulties (Krust & Schuchman, 1991), this becomes a

logistical issue when mechanical equipment breakdowns occur if the equipment technicians are located in major regional centres.

The types of dental procedures that can be effectively delivered by a mobile dental service were reported by participants from the NGO MDS to be mainly restricted to basic dental restorations and the provision of preventative dental care, rather than the more complicated and comprehensive dental treatments such as crown and bridge therapy, root canal therapy and denture construction. Time constraints placed on the mobile dental service, with the two weeks maximum time that the free service could stay in each community, were in part responsible for this limitation in treatment options offered. A further cause for this limitation in service types was the lack of ready access to a dental technician who works collaboratively with the dentist by constructing dental appliances from dental impressions sent to them. These impressions must be sent in a timely manner or they distort due to temperature fluctuations and length of time in transit (Thongthammachat et al., 2002). A review of the literature about mobile dental service programs that have been successfully implemented in other developed and developing countries, supports these finding and suggests that the most suitable applications for mobile dental services are for: the education of school children regarding oral health; community and school preventative dental health programs such as fissure sealant applications; screening for various oral diseases and; the provision of preventive services to homebound people, homeless people, or migrants (Ganavadiya et al., 2014). The appreciation and understanding of the inter-connectivity between good oral health and overall medical health (Critchlow, 2017; Hayashi et al., 2017; Liljestrand et al., 2016) is a major issue that needs to be addressed worldwide, and the role in improving this oral health literacy in rural and remote Queensland may be addressed by a mobile dental service. Consequently, the raising of awareness in communities of the importance of good oral health is seen, by all of the participants as one of the major advantages of a regular dental service that can be provided by a mobile dental service.

The uncertainty surrounding the continuation of funding for this mobile dental service in Queensland is problematic. Funding for these types of mobile services in other parts of the world are usually provided by a combination of collaborative co-operations from: professional dental associations, NGOs, the government sector and charitable fundraising events by the communities (Ganavadiya et al., 2014). Participants reported that they were reluctant to give up their relationships with existing local dental practitioners, as they were afraid that if they did not continue to support those few rural and remote dental practitioners in their regions, those dental practitioners might be forced to leave their communities due to lack of support.

Exploitation of this free mobile dental service was reported as a minor challenge to the service. Participants from the primary care networks cited examples of instances where patients had

presented with dental treatment plans established by the regional dental practitioners in capital cities. These patients had then travelled to the NGO Mobile Dental Service, whilst on vacation, and followed the van from community to community until their dental work had been completed for free. There are always ways within any system to exploit it, but the practitioners from the mobile dental service in Queensland were not overly concerned about the advantages taken by a few travelling nomads who had found a clever way to manipulate the system.

Mobile dental services, such as the NGO MDS, offer an effective method of servicing hard to reach communities. Subsequently, the government dental practitioner from the second case study was in the process of establishing a mobile dental unit to travel to outreach centres within his district, unrelated to the free service offered by the NGO MDS. This method is supported by previous literature which suggests that the most effective oral health care delivery model for rural and remote communities consists of a combination of both fixed and mobile dental services (Appiah, 2012). Furthermore, if these government employed dental practitioners were able to treat both government and private patients, then it is suggested by participants that this might be a very effective way to service some of the harder to reach, smaller population based communities that exist in rural and remote Queensland.

5.3 Research Question 2

The second research question sought to determine the relationships that existed between non-dental primary care providers and dental personnel from the eight Queensland communities examined. The results showed that there was limited interprofessional communication between non-dental primary care providers and dental personnel.

5.3.1 Interprofessional communications

The term “relationship” referred to the level of interprofessional communications and collaboration that occurred between the two professional groups. Interprofessional collaboration is the method by which different professions worked together to improve the quality of overall patient medical and holistic care (Valle-Oseguera & Boyce, 2015). Literature reports that residents with limited access to oral health services presented to primary care providers with oral health problems for advice and treatment (Retchin & Sheldon, 2008). It is suggested by this researcher that better interprofessional collaboration between dental care providers and rural primary care providers could improve oral health care for rural residents.

In this study, high medical staff turnover in rural regions and the separation of oral health from overall health were factors described by participants as contributing to the lack of interprofessional

collaboration. The transient nature of the many locum General Medical Practitioners and pharmacists in these eight rural and remote Queensland communities meant that interprofessional relationships with dental practitioners often could not be successfully formed. Many of these doctors rotated to different medical facilities every three months and the dental visits also often only occurred at three monthly intervals. Rural medical staff were described as “always changing”, “not stable”, “relieving ones” and “completely different”. Previous literature has also reported that locum medical practitioners struggle to stay in regions for long periods of time (Li et al., 2014). Reasons for this have included difficulties in being away from families, different office policies and differing medical software packages (Seid, 2011). As a consequence, primary care providers may not have made the most effective use of the dental services that were available to their communities.

Only a few studies have explored the interprofessional relationships between dentists, doctors, pharmacists and allied health care practitioners. These studies have also highlighted the lack of collaboration and interprofessional communication between dental and non-dental professionals (Bissett et al., 2013; Graham et al., 2003; Gussy et al., 2006; Patel et al., 2012; Tenenbaum et al., 2008). The lack of interprofessional communication experiences reported by most of the participants from this study was exacerbated by the reported confusion surrounding the different mechanisms available in their districts for oral health care delivery. Only a few dental personnel reported that they had some good experiences where they had communicated well with General Medical Practitioners in the rural areas visited. Similarly, a European study reported that the dentists interviewed in that study, described their relationship with doctors as good or excellent whilst the General Medical Practitioners rated their relationships with the dental practitioners as non-existent or poor (Tenenbaum et al., 2008). Historically the two different professional groups have exhibited exclusivity in relation to professional skill sharing (Oral Health Monitoring Group, 2015). This could begin to be addressed at university level where interdisciplinary collaboration and education would encourage breakdowns of these boundaries, as evidenced by studies of other non-Australian universities (Boyce et al., 2009). Interdisciplinary communications and collaborative approaches to chronic care would likely break down the siloed behaviours exhibited by professional groups (Begg et al., 2015; Landman et al., 2014; Vallis, 2016).

Villa suggested that dental practitioners had a specific specialised skill set related to the oral health of an individual, whilst General Medical Practitioners, had broader skill sets which encompassed the entire body and often deferred their judgement on dental issues to dental practitioners (Villa et al., 2015). This essentially siloed the two professional groups, where in fact dental and medical health are intimately related. Medical conditions including cardiovascular disease, stroke, diabetes and adverse pregnancy outcomes have been associated with oral diseases such as periodontitis and

gingivitis (Lopatin et al., 1980; Mealey & Ocampo, 2007; Scannapieco & Ho, 2001; Simpson et al., 2010). Patients with co-existing medical and dental issues would benefit from a combined treatment plan formulated with co-operation by dental and medical health care professionals (Andersson et al., 2007; Mouradian et al., 2004; Slavkin & Baum, 2000). In 2007, the World Health Organization agreed that better integration between chronic disease prevention programs and oral health care was essential to improving patient health (Vieira & Caramelli, 2009) and a more collaborative approach to the overall patient's health care would benefit when information sharing and interprofessional collaborations between the two siloed professional groups occurs (Gussy et al., 2006). Complex medical issues often seen in patients could be more effectively addressed with interprofessional health care teams (Andrews, 2017; Nguyen et al., 2017).

5.3.1.1 *The community based "lynch pin" person*

In this study, dental personnel who were long-term residents of the community were likely to have strong professional relationships with the primary care networks health care providers. The long-term resident dental assistant from the first case study of this research project was the "lynch pin" liaison person between the rural primary care networks in those four communities and oral health services. This dental assistant had lived in the community for more than 20 years and was friendly with many of the allied health, nursing and medical practitioners. The necessity for the primary health care network to make all referrals and appointments through the Central Referral Unit, and the dissatisfaction with this system, meant that this dental assistant was often directly contacted, often at her home residence, for dental advice and expedition of dental appointments. This community had come up with a plan to work around the inefficient Central Referral Centre model of oral health care delivery and created an unofficial liaison or information brokerage role, for this dental assistant. Literature has reported that long term community members who are not dental practitioners may also be an alternative "go to" resource person for dental triaging (Lam et al., 2012).

The government-employed dental therapist in the second case study also had a good relationship with the non-dental primary care network members in her community, as she was a long-term resident in this district. This therapist had been in the region for 20 years and was another "lynch pin" for interprofessional communications. This dental therapist had an extensive network of dental specialists in major regional centres who she advised patients to see and, before the governmental dentist was in the community, was a major source of dental advice for residents from communities in the second case study.

The information sharing and communication between the visiting government services and the primary care providers in the first case study, was so poor that the arrival of the government dental

practitioner into Town D was not advertised in any way. At the time of interviewing the primary care network in this first case study community it became apparent that these participants were unaware that the dentist was in their town and had been in their community for two days. The fact that the government dental clinic in Town D was not physically attached to the hospital was an exacerbating factor which meant that hospital staff when unaware of the arrival of the dentist. The lack of any formalised notification processes for the operating times for the dental surgery, meant that this service was underutilised. The government dental practitioner was busy addressing the referrals from the 1300 service and did not advertise their arrival times due to the lack of spare patient appointments. This lack of direct interprofessional communication with the government dental provider made the oral health delivery mechanism in the first case study an unsuccessful model.

5.3.1.2 *Government Dental Practitioners and the Rural Primary Care Network Participants*

The government dental practitioner in the second case study was a recent graduate dentist from a regional university and described instances of interprofessional education experiences at university level and was starting to form tenuous relationships with the primary care networks. Interprofessional collaborations and patient information sharing were informal in nature and sometimes "corridor" chats with medical practitioners about certain patients spontaneously occurred, but only rarely were referral letters or phone calls received asking for dental advice. The interprofessional relationships formed at university level with health care providers such as pharmacists and medical practitioners were described by this recent graduate dental practitioner as a major factor in the mutual respect shown between these professional groups. This was corroborated in the literature which advocated for interdisciplinary education at university level (Boyce et al., 2009). Being young and single, this dentist enjoyed social outings with the medical staff at the hospitals and the living arrangements, being housed together, were conducive to this professional relationship and friendship building.

5.3.1.3 *Private Dental Practitioners and the Rural Primary Care Network Participants*

The resident private dental practitioners in the outlying hub communities described only rare instances of interprofessional communications with members of the primary care networks from the examined rural and remote case study communities. The fly-in fly-out private dental practitioner from Case Study 2, described having no relationship with any members of the primary care networks. This type of poor interprofessional relationship has also been reported in previous literature (Gussy et al., 2006).

5.3.1.4 *NGO MDS Dental Personnel and the Rural Primary Care Network Participants*

In contrast, some dental personnel from the NGO Mobile Dental Service, formed relatively good relationships with some members of the non-dental rural primary care networks in the communities they visited. These communications were mainly regarding logistical issues in relation to the arrival of the large 18-wheeler semi-trailer truck into those communities. The organisational dental personnel such as the Practice Manager and the dental assistant were the main dental personnel to form collaborative relationships with the DON's, nurses, hospital administrative staff, and with non-medical active community members such as police officers, teachers, hospital cleaners, and local council representatives.

It was uncommon for visiting dental personnel to have contact with General Medical Practitioners or pharmacists, but it was more common for them to have contact with hospital Directors of Nursing (DONs), Nurse Practitioners, allied health professionals, administrative staff and auxiliary health care workers. These members of the primary care networks were often long-term and committed community members who were appreciative of the arrival of the free mobile dental service. Some DONs collaborated with the NGO MDS by distributing pamphlets and contacting patients directly, thereby increasing the number of patients subsequently treated by the service. However, conversely some primary care providers did not always appear interested in oral health issues and were reluctant to approach the dental personnel to cooperate in promoting oral health to local communities.

General Medical Practitioners in these communities visited by the NGO MDS were often locum doctors who would stay for three months in the community. They were often not available for interprofessional collaborations for post-operative care for dental patients when the truck left the communities, because these locum doctors themselves would not be around to implement this post-operative care. The literature supports the struggles that locum General Medical Practitioners face (Li et al., 2014; Seid, 2011).

Pharmacists also did not report forming professional relationships with dental practitioners from the mobile dental service. This finding is supported by previous literature suggesting that the only communication that occurs between pharmacists and dental practitioners is in relation to errors on scripts and requests to supply specific for oral health products (Jacobsen & Lofholm, 2008).

5.3.1.5 *NGO MDS and Incumbent Dental Practitioners*

Previous literature supports that the financial viability of a private rural or remote dental practice is dependent on having a large enough population to whom services can be delivered on a regular and reliable basis (Chrisopoulos et al., 2016) and consequently the distribution of dentists closely reflects

population distribution. This is supported by the literature that reports remote and very remote regions having approximately 25.7 dental practitioners per 100 000 population, whilst major cities have 63.1 dental practitioners per 100,00 population (Chrisopoulos et al., 2016). The relationship between the dental practitioners from the NGO MDS and existing government dental practitioners who service these communities, was less complicated than the one with existing private resident or fly-in fly-out private dental practitioners. On the one hand, the busy and often overworked government dental practitioners were often grateful for the help offered by the NGO MDS to provide oral health care to those patients that they were too busy to see and also to those from outlying remote areas that they could not service. On the other hand, the private resident dental practitioners relied on those remotely located dental patient residents to travel to their established hub community surgeries to make their practices economically viable. This financial incentive was a significant motivation for the local dental practitioners and the other FIFO dental practitioners, to continue their private dental practice. Private dental practitioners made huge financial and lifestyle commitments to set up a dental practice in rural and remote regions, and their continued sustainability relied on the maintenance of a critical patient population demand. Some private dental practitioners held the view that that too many services like the NGO MDS would deplete this demand. Previous studies had questioned the reliance of rural and remote people on fly-in fly-out health professionals to improve equity of access to services, suggesting that the most reliable health care provision is found when the primary care health care team is resident in a community (Wakerman et al., 2012)

5.3.2 Referral Processes and Pathways

Members of the primary care networks often referred patients with dental issues to a dental service, via phone call or referral letter. However, knowledge about how the different oral health care services worked, such as their availability and operating hours, and the lack of feedback from these services, were a challenge to effective interprofessional communication and relationship formation. Some non-dental primary care participants commented that they had only recently started work in the Queensland district examined and that the referral processes were different in each of the different hospital health services across Queensland. This suggested that a standardised referral system across all the hospital systems for government dental services and a visible listing of the available private dental practitioner contact details in each region, would be beneficial to improved communications. This has been evidenced in the literature with the suggestion that formalised referral processes need to be established to allow an integrated and shared approach for medical and dental care universally (Dyson et al., 2012; Gussy et al., 2006). The lack of acknowledgement of referrals by dentists caused frustration for some members of the primary care networks, especially

when these same patients returned with medical issues, which may have been related to the original on-referred presenting dental problem, and the practitioner was not informed as to whether or not the issue had been resolved by a dental practitioner or not. Dental problems left untreated may develop into major medical emergencies and can contribute to potentially preventable hospitalisations (Kruger & Tennant, 2015).

The findings from the literature endorsed the formation and maintenance of effective two-way communication and referral pathways between non-dental primary care providers and dental practitioners as an effective way to manage and prevent oral health problems (Dyson et al., 2012). However, difficulties and frustrations with this referral process were reported by rural primary care participants in the first case study's communities.

5.3.2.1 *Referral processes in Case Study 1*

In the first case study the referring non-dental health care professional would leave a message containing patient details on a Central Referral Centre call centre answering service, but rarely received any feedback as to whether the patient had received dental care or not. The lack of response from this 1300 number was a common complaint from referring primary care providers. The members of the rural primary care network acknowledged the inefficiency of this referral process in their region but were powerless to improve the situation due to the perceived inapproachability of the government-funded Central Referral Unit. The lack of personalisation of the system with an answering machine at a 1300 number was perceived to be a definite break in the communication between the rural primary care network and oral health care professionals. Consequently, many primary care providers made direct contact with the government clinic dental nurse (often even at her home address) to circumvent the suggested inefficiencies of the 1300 number system. At other times, private dentists in surrounding communities were directly contacted. The communication network had broken links between rural primary care providers and dental practitioners and confusion existed around the protocols for referral. Consequently, oral health problems for these four communities were very poorly dealt with.

5.3.2.2 *Referral processes in Case Study 2*

In the second case study, patients from the three communities travelled to see the government dental practitioner in one of the two locations. The referral pathway was to make direct contact with the dental practitioner or dental assistant, and the health care providers from this district were satisfied with this structure. Referral directions were clear and there was little confusion as to who was the government dental practitioner. The referral processes were informal with either phone calls being made on behalf of patients to the dental clinic or with the patients directly ringing to make appointments themselves. Little formalised feedback occurred, as was the situation in the first

case study, but primary care providers from this second case study described fewer frustrations than those from the first one. In the second case study it was possible for the non-dental primary care providers to make direct contact with the government dental clinic if desired, instead of only being able to leave a message as with the Central Referral Centre model. General Medical Practitioners from the second case study described fewer oral health presentations, between one and five a month, than to the first case study and this may be attributed to the clearer referral pathways that existed.

Primary care providers from this Queensland district recognised that the ease of contact and the stability and continuity of these government dental services was the first step in solid relationship and friendship formations between health care professionals. The ease of referrals in this second case study aimed to integrate many allied health care providers including dental practitioners into established local professional roles and relationships.

5.3.2.3 *Referral processes in Case Study 3*

The referral processes for the third case study, which involved the NGO MDS to Towns E, F, G and H, were also informal in nature, with phone call referrals being more common than written referrals. The reason for this informality of referral protocol was the mobile nature of the dental unit and the time limits imposed by the short two week stays. However, the formality of email referrals was described by some participants as desirable to enhance interprofessional communications and record keeping. The NGO MDS had an extensive advertising process where the communities to be visited were given several weeks advance notification of the arrival of the service. Promotional posters were sent out in advance, advertising contact numbers for the service and notifying arrival dates and times and were prominently displayed on community notice boards and in shop windows. Patients rang to directly book appointments before the truck arrived in the community. The NGO MDS believed that their service had raised community oral health awareness, which was a benefit in addressing one of the significant barriers faced by rural and remote communities. This visibility and availability enhanced the informal referral processes.

5.4 Research Question 3

The third research question aimed to determine what strategies have been suggested to improve oral health in the rural and remote regions examined. In the current study, participants detailed a number of generalised strategies that could contribute to better oral health care in all of the eight communities examined and included: providing improved preventative oral health strategies, upskilling the non-dental primary care network to assist people with dental health problems, providing alternative dental service delivery models, encouraging recruitment and retention of

dental professionals in rural and remote areas, and improving interprofessional relationships between dental practitioners and the non-dental rural primary care networks.

It was discovered as this research project progressed however, that not all the suggested strategies could work in all of the communities, as the circumstances surrounding the oral health care delivery models were different within each of the three case studies. The specific strategies suggested to improve the oral health care service provision in each of the three case studies will consequently be discussed separately. Following is a discussion of the common strategies suggested by participants to improve oral health and service delivery in the communities examined.

5.4.1 Preventative oral health strategies

The prevention of oral health problems was seen by participants from this study to be a vital strategy to improve the oral health status of residents within the eight communities examined. If oral health issues were able to be addressed with oral health promotion, oral hygiene instruction and with the introduction of water fluoridation to town and tank water supplies, then the "band-aid" type of problem-based dentistry that was most common in rural and remote communities might be more successfully addressed (Teusner et al., 2013). The authors of this study in 2013 argued that Australians spend more money fixing dental problems than they could have spent on preventing them in the first place.

5.4.1.1 *Oral Health promotion*

Increasing promotion and education on the medical importance of good oral health was believed to be a crucial factor by many participants in raising oral health awareness for residents in the communities examined. Participants suggested that this might be delivered and achieved by existing community non-dental primary care providers such as General Medical Practitioners, pharmacists and allied health care providers. Literature suggests that the introduction of oral health promotion programs in schools and kindergartens could utilise other non-medical services to increase community oral health awareness (Neumann et al., 2011). Introducing dieticians to these programs to teach good food and beverage choices for maximum oral health was suggested by participants and supported by previous research, as a strategy to promote the importance of oral health to families (Boyce et al., 2009). The participants suggested that the role of parents in reinforcing good oral hygiene practices needed to be emphasised. Further education opportunities for new mothers was suggested by some participants with the inclusion of dental education material in baby packs given to new mothers at time of hospital discharge after delivery of their babies.

Pharmacist participants from this study expressed their frustration with their lack of understanding and education for dental issues. They had dental presentations as often as 10-15 times a week.

More than 90% of the Australian population visit a pharmacy each year, with the average Australian visiting up to 14 times a year (Benrimoj & Frommer, 2004). In 2013, pharmacists were contacted as frequently as medical doctors and twice as frequently as hospital emergency departments for toothache pain (Cohen, 2013). As one of the most widely utilised health care professionals, pharmacists could play an important role in oral health promotion by displaying posters in their pharmacies and giving customers oral health information pamphlets thus improving oral health literacy to communities. A greater role for pharmacy counter assistants in oral health promotion was also reported in the literature as a way to educate communities in relation to good oral health (Steel & Wharton, 2011).

Some participants suggested that rural child health nurses and community health nurses could play a larger role in educating parents and children in oral health care. Oral health education with the promotion of the benefits of good diet and early exposure to fluoridated toothpaste was reported in a 2001 study where oral health starter kits were distributed to parents of pre-school children during clinic visits and in schools (Neumann et al., 2011). The distribution of free toothbrushes and toothpastes to members of rural and remote communities was suggested by many of the participants in this study as a cost-effective investment in preventative oral health care, due to the high cost of these dental aides in rural and remote regions. This was also evidenced in a study from rural and remote Indigenous communities in 2017 indicating that the high cost of toothpaste was an inhibiting factor to the use of this oral health care product (Jamieson et al., 2017).

5.4.1.2 *Water Fluoridation*

Reduced access to preventative measures such as fluoridated water has been shown to contribute to the poorer oral health associated with rural and remote communities (Crocombe et al., 2016; Ehsani & Bailie, 2007). Water fluoridation of the town supplies of these Queensland communities was endorsed by participants as a reasonable, cost-effective public health intervention which has been shown in the literature to reduce dental caries across the population (Satur et al., 2010). The most comprehensive report from the National Health and Medical Research Council recently published in 2017 states unequivocally:

> *NHMRC strongly recommends community water fluoridation as a safe, effective and ethical way to help reduce tooth decay across the population. (National Health and Medical Research Council, 2017).*

5.4.2 Building the capacity of rural primary care practitioners

Oral health workforce shortages in the Queensland rural communities studied in this research project, have resulted in creative innovative solutions to the problems associated with residents'

inability to access timely dental care. The World Health Organization's global policy for improvement of oral health (Petersen, 2008) advocated for the training of non-dental primary care providers in techniques to manage emergency dental presentations in the absence of dental practitioners.

Improving the understanding of non-dental health care providers in preventative and basic emergency dental procedures would benefit those patients who are unable to access oral health care easily. Educating medical practitioners and other allied health care providers in dental nomenclature would allow a common medical/dental language which would consequently encourage better inter-professional collaborations. Most of the non-dental primary care network members interviewed for this study were keen to learn about basic dental skills, recognising that this was often ignored in their university educations (Tenenbaum et al., 2008). The literature supports the inclusion of regular oral health topics in professional development programs for health professionals working in rural and remote areas. (Neumann et al., 2011).

Including preventative oral health care into general medical health screenings, was an intervention suggested by participants from this study as a strategy to improve the oral health of these residents from rural and remote Queensland communities. Building the capacity of the existing members of the non-dental rural primary care networks to deal with oral health issues by upskilling them in oral health knowledge, was also a strategy suggested from the findings in this research project. It was suggested that non-dental care providers might have a role in educating and promoting oral health to their patients. Australia's National Oral Health Plan 2015-2025 supports these findings and suggests that medical professionals who engage with families and children regularly may play an important role in providing preventive oral health care, dietary advice, teaching the importance of good oral hygiene for overall medical health and by encouraging regular dental visits (Oral Health Monitoring Group, 2015).

The introduction of oral health screening appointments into general medical interventions within primary care, such as in child health nurse or medical milestone appointments, was advocated by participants in the communities examined. Primary care participants from this study recognised their need to better manage oral health presentations and expressed their interest in practical upskilling in dental emergency management. Community health nurses interviewed for this research project suggested that they might play a stronger role in educating children and parents on oral health care during clinic visits and in schools. This finding is supported in the literature where rural maternal and child health nurses delivered an oral health intervention program with the distribution of oral health starter kits to parents of pre-school children and with the promotion of childhood exposure to fluoridated toothpaste (Neumann et al., 2011).

Non-dental primary care providers from this study expressed their need for dental education programs in the management of emergency dental issues. The inclusion of oral health training and dental topics in continuing education programs for rural and remote health care practitioners is not widely reported in the literature and training programs for General Medical Practitioners in other parts of the world mainly concentrated on the doctor's role in providing preventive services, oral screening and assessment for younger population groups (Mouradian et al., 2004). Most General Medical Practitioners, pharmacists and other health care provider participants from this study reported that their competing educational priorities and work schedules dictated a preference for flexible education formats with training such as: professional journal papers and professional newsletters; online short courses; participation in short workshops for practical skill training in dental emergencies; training modules provided through The Royal Australian College of General Practitioners, the Australian College of Rural and Remote Medicine and the Royal Flying Doctor Service and; through reading the specific emergency dentistry chapter in the Queensland Clinical Care Manual available in all Emergency Hospital Departments. The suggestion was to introduce emergency dental management workshops in the induction and training processes for General Medical Practitioners and other allied health care providers, before they begin working in rural and remote practice. This finding was corroborated in the literature that examined the acceptance by non-dental health care providers of a short dental emergency education program. This program involved medical practitioners receiving a brief course in emergency dental techniques and being given an emergency dental kit, with temporary restoration materials to take to their clinics. The attendees reported a very positive response to this briefly trialled education program (Skapetis et al., 2011; Skapetis et al., 2013).

The literature also suggested the expansion of the role of pharmacists in emergency dental management (Buxcey et al., 2012), and although it has been reported in literature that people often present to pharmacists for oral health care advice (Dickinson et al., 1995), continuing education programs for pharmacists in oral health issues are rare. It has been suggested that pharmacy counter assistants could also have a greater involvement in oral health promotion because of their frequent interactions with customers (Steel & Wharton, 2011). Pharmacists interviewed from this research project also reported a lack of resources and training relating to oral health and its relationship to systemic disease, suggesting the need to implement training programs in dental emergency management for pharmacists.

Pharmacists interviewed in this Queensland study reported communication breakdowns with dental practitioners and the desire to learn from them about which products might be suitable to stock in their pharmacies for dental emergencies. Pharmacists from this research project agreed that dental

product recommendations should be dentist-driven and that oral hygiene education could feasibly be performed in pharmacies, time allowing. Rural pharmacists in a previous study supported these findings and also reported issues with dental prescriptions and their lack of understanding regarding oral health care products and a lack of support for their integration into primary health care teams (Maunder & Landes, 2005). Pharmacists could consequently take on a more active role in raising community oral health awareness by displaying oral health posters in their stores and providing oral health information to patients.

An Australian study in the Northern Territory (Slade et al., 2011) established that due to a heavy workload and a high turnover of remote health care workers, the provision of preventive dental services through nurses and Indigenous Health Care Workers was limited. However, it has been established in previous literature that there was a high degree of support for the need to establish some level of oral health education training for Indigenous Health Care Workers before they commenced working in rural and remote communities (Blinkhorn et al., 2012; Walker et al., 2013). The Indigenous health care participants from the second case study reiterated this need for further training in preventative oral health care education and reported many examples of instances where they had people in their care with very poor oral health due to a poor diet. These participants described the specific financial barriers that their clients faced in relation to the purchase of oral hygiene products, such as toothbrushes, and described how many of their patients exhibited a lack of understanding of the co-dependencies between oral and medical health conditions.

In response to this need for a dental triage educational program for non-dental primary care providers, the candidate has developed a series of presentations offering emergency dental management techniques for General Medical Practitioners, pharmacists and allied health care providers. These lectures were delivered throughout 2016-2017 in Queensland via: a lecture circuit with the North Queensland Primary Health Network; rural general medical practitioner study groups and workshops and; to final year medical students in Queensland University Medical Schools. The feedback from attendees has been overwhelming and these presentations are expected to be continued into the future. It is estimated that to date, over one thousand General Medical Practitioners in Queensland have attended these presentations with the consequence that many of those primary care providers now feel better equipped to manage dental emergencies in their rural and remote practices.

5.4.3 Alternative dental service delivery models

Alternative dental service delivery models have been suggested as a strategy to improve service provision to rural and remote Queensland communities. These alternative dental service delivery

models include: a mixed model of government and private care by the same dental practitioner, the increased utilisation of auxiliary oral health care providers such as dental therapists and hygienists, the provision of mobile dental clinics, the transportation of patients to dental clinics and the greater utilisation of undergraduate dental students.

5.4.3.1 *A mixed public and private oral health care delivery model*

The World Health Organization recommends a dentist to population ratio of 1:7500 for achieving optimal oral health. The population base in rural and remote communities is often much lower than this and consequently a private dental practitioner alone would not have enough patients for a viable commercial practice. Similarly, the government-employed dental practitioner participants, who can only treat approximately 12% of the population living in remote or very remote areas of Australia (Australian Bureau of Statistics, 2013b), expressed their frustrations when they were not allowed to also treat private patients in hospital-based facilities purely because those patients did not have a Health Care Card. Offering duel practicing rights for dental practitioners to work as both government and private dental practitioners, was a commonly proposed strategy by participants from this study for the provision of better, more sustainable oral health care services. This would allow the dental practitioner to better utilise their time by servicing all the residents in these smaller rural and remote communities. Dental practitioners described the limitations to their treatment options when locked into government dental practice, which resulted in reduced comprehensive treatment choices for Health Care Card-holding patients and the subsequent loss of professional skills, especially if the dental practitioners were recent dental graduates. This type of duel practice has been reported in the literature as being successful in medical practice (Banda et al., 1994; Johannessen & Hagen, 2014). A study in 2017 also supported a flexible approach to oral health services funding via this mixed delivery approach particularly for those at-risk communities that have difficulties accessing to oral health services. The mixed delivery approach may potentially avoid more costly treatments or hospitalisations (Carlisle et al., 2017).

A mixed delivery model encompassing the ability to treat both public and private patients from the same premises could enable dentists to provide services to the entire community in a financially viable and ethical manner. This mixed private-public business income model for dentists would improve services to private patients who do not hold Health Care Cards, enabling them to access care from the visiting or resident dental practitioner without the expenses incurred of travelling outside the community to access oral health care. Establishing on-site dental clinics that could be utilised by a dental practitioner working in the dual role as government and private practitioner would mean that those communities where the population base was too small to support a private dentist alone would benefit from regular oral health care provision. Similarly, a private dentist may

be more willing to set up a practice if state-based public dental services outsource services to them, thereby ensuring adequate patient throughput.

5.4.3.2 *Increased utilisation of auxiliary oral health care providers*

A further role for auxiliary oral health care providers such as oral health therapists and dental hygienists could be explored in their capacity as preventative and educational oral health promotional roles, supporting regular visits by both public and private dentists (Baltutis & Morgan, 1998). Canada, Finland, New Zealand and the UK are utilising dental auxiliaries as a result of workforce shortages and the high levels of oral health issues in their countries (Kravitz & Treasure, 2007). The treatment provided by dental therapists in the School Dental Service in Queensland, was an important strategy to ensure that school-aged children received appropriate oral health care. This vulnerable group within the communities often face challenges to good oral health and studies have shown that Queensland children aged 0–14 years living in rural and remote communities were hospitalised for dental conditions three times more often than residents in the rest of Queensland (Carlisle et al., 2017). The eight communities examined for this research project reported a workforce shortage of oral health therapists and hygienists. The first case study did not have an active oral health therapist, as she was on maternity leave, and the second case study had only one dental therapist who was short-staffed and overworked.

The utilisation of dental hygienists to provide oral health services to rural and remote communities has been explored in the literature. Legal, regulatory, and ethical considerations create complexities for these oral health care providers in other parts of the world (Maxey et al., 2017; Zarkowski & Aksu, 2016). To date these highly versatile oral health professionals have not been utilised in the eight communities studied suggesting a potential role for these oral health care providers.

Dental technicians are an essential member of the oral health care team and yet none of the eight communities examined had a dental technician in residence or even in a nearby community. All dental laboratory work was sent to the capital cities. Participants from this study reported the high incidences of dental extractions to treat tooth aches and the large number of residents who went "toothless" due to the lack of access to a dental technician to make the denture to replace the extracted tooth. In the UK, registered clinical dental technicians were considered to be an occupational group within dentistry (Leyssen et al., 2013). However, another study suggested that the role of the dental technician was outside of the "dental team" due to their limited direct patient contact (Morison et al., 2011). This suggests the need to further explore the roles of dental technicians in providing the much needed dentures to rural and remote patients. A mobile dental technician service, *"The Denture Adventure"*, had visited the communities several years before and

had made dentures for those people who needed them. This service was very well received, suggesting the importance of dental technicians to patient wellbeing.

5.4.3.3 *Mobile oral health service delivery model*

The utilisation of mobile dental units to deliver oral health care to residents in rural and remote communities has been suggested as an effective strategy in other parts of the world (Vashishtha et al., 2014). Literature on the efficacy of mobile dental units worldwide was performed in 2012, that established that mobile dental clinics are a successful way to improve access to oral health care in underserved populations with a benefit being the improvement of overall oral health in these individuals (Appiah, 2012).

At the time of the interviews, the Chief Medical Officer of the second research district was in the process of finalising details for a "*Dental Drover*", which is a small truck with a fully equipped mobile dental clinic. The dental practitioners servicing the Case Study 2 communities would have to obtain a truck driving license as a requirement for employment. This service is to be part of the government dental clinic and would travel to outlying communities and offer oral health services to those patients who were eligible for treatment (those holding a Health Care Card).

The school dental service is a government-funded mobile dental service consisting of large caravan that is equipped as an operational dental surgery and is towed by a towing service to schools around the districts. These mobile clinics are manned by a school dental therapist and a dental assistant and require a dental practitioner to oversee their treatments at regular intervals. At the time of interviews, the school dental services in both Case Studies 1 and 2 were not operational due to staffing issues.

5.4.3.4 *Indigenous Services Mobile Dental Service*

The Indigenous patients from Case Study 1 communities could access oral health care from a mobile Indigenous Oral Health Care Service which visited Town C and D intermittently. Patients who did not hold a Health Care Card could access this service for a fee, but only if they were of Indigenous heritage. This service has been superseded in recent times with a fixed clinic now located in Town D (Goondir Health Services, 2018).

5.4.3.5 *The NGO Mobile Dental Service*

The NGO Mobile Dental Service is a joint initiative with the NGO and a private mining company group. The third case study of this research project examined this service delivery model in detail and the benefits of this service to residents in rural and remote Queensland and will be discussed in detail in a following section.

5.4.3.6 *Providing transportation for the patients to oral health services*

A strategy proposed by participants as a solution to the issue of lack of oral health care access was to deliver the patients to the dental service rather than expecting it to come to them. This alternative model could help reduce the cost and burden of travel to a regional centre to access dental care. Some local councils and charity groups in a few of the Queensland communities examined supply funding for government-eligible patients for bus fares to attend the government dentist in the larger hub communities. Some charities also offer assistance with private transport by volunteer drivers to take patients the long distances to access oral health care. Indigenous Health Care Workers from the second case study gave examples of instances where they had driven their own vehicles at times, to deliver their clients to the government dental clinics. A search of the literature revealed no studies examining this strategy, suggesting that it is an innovative idea.

5.4.3.7 *Utilisation of Undergraduate Dental Students*

An Australia wide programme was established in 2013 and ceased in 2015. Graduate dentists were offered a full 12-month paid experience gaining exposure to a variety of clinical experiences by working in rural and remote locations with mentor dentists (Swan, 2013). The Voluntary Dental Graduate Year Program (VDGYP) was funded by the Australian Government Department of Health. The government dental practitioner from the second case study was employed this way. Currently, there is a compulsory rotation of dental students in their final year of study, before graduation, to rural government dental clinics, for students from Queensland dental schools. The introduction of the dental students to rural and remote practice has been successfully used as a recruitment tool for the rural communities (Verma et al., 2016).

The use of final year dental students has benefits for rural patients in that they receive oral health treatments, albeit from an inexperienced undergraduate dental practitioner under supervision of experienced dental practitioners (Abuzar et al., 2009). Some dental practitioners believed it gave students an excellent opportunity in a stimulating environment to achieve adaptability in treatment planning and procedures (Ratilal et al., 2013). The dental students themselves often described the rural rotation experience as very positive, with the opportunity to understand the specific cultural and oral health needs of Indigenous Australians being a key factor in increasing the attractiveness of rural practice. A similar rotation has been trialled for medical students where they were required to participate in community-based rural health placements. Medical students subsequently reported their increased appreciation for, and interest in, working in a rural practice (Critchley et al., 2007).

A study by Ratilal and colleagues in 2013, described the outcome of rural dental student placements, where the students subsequently decided not to seek employment in rural locations after graduation due to the desire to be close to family and the professional support and social life in a

city. They described the considerable debt that most dental students graduated with and admitted that the possible income in the private sector was much higher than in the public sector for new graduates. Consequently, the beneficial impact of rural rotation experience might only be realised when they felt professionally confident and financially secure enough to venture into rural locations (Ratilal et al., 2013). Findings from several studies suggest that very few students imagined their careers to continue in only one location for the whole length of their career (Orpin & Gabriel, 2005).

At the time of interview, the increased utilisation of dental students to deliver oral health services was being examined for Town D, with the possible establishment of a clinic for Indigenous clients via a partnership between the University of Queensland and Goondir Health Services offering a rural placement for fifth year UQ dental students (Bradfield, 2016). This has now been established and it will be interesting to watch how this idea develops (Goondir Health Services, 2018).

The more effective utilisation of dental students has been suggested by participants in this study as a solution to better oral health service delivery to rural and remote communities. Studies show that dental practitioners from rural backgrounds were more than twice as likely to work in a rural practice as those from urban backgrounds (Godwin et al., 2017).

The criticism for this model of oral health care delivery is in relation to the effect of this final year on the young student dentists themselves. The final year is where the "fine tuning" of oral health education takes place and it was a concern for most of the dental professionals interviewed in this study, that these students were missing out on a full year of extra training in advanced dental techniques and may be being taught bad habits by being exposed to emergency dentistry only. The other type of dental care, comprehensive dentistry, encompasses more clinically challenging procedures such as molar root canal therapies, crown and bridge techniques and denture fabrication processes. Ratilal and colleagues in 2013 described dental students on rural placements as having expressed concerns that their electronic access to the university's online learning sites and their access to lectures were suboptimal due to poor internet access. Fluctuations in power supply resulted in frequent equipment breakdowns which was frustrating when new students were learning difficult skills (Ratilal et al., 2013).

5.4.4 Encouraging recruitment and retention of dental practitioners.

The Chief Director of Medical Services in the second case study of this research project actively recruited dental students in the hope of "growing your own" where the student was mentored professionally and socially so that they grew to enjoy the rural and remote lifestyle and perhaps even meet their life partner and settle permanently in the region. Other studies have shown the

success of this strategy with the successful formation of strong social bonds within the community and enjoyment of the rural lifestyle (Godwin et al., 2014; Hall et al., 2007).

Most of the participants from this study suggested ways of attracting other experienced dentists to rural and remote practice which included promoting lifestyle factors and offering financial incentives. Strategies to overcome the limiting lifestyle factors reported in the literature that need to be addressed to attract the dental workforce include: offering good accommodation, offering good schooling facilities, offering community cultural activities to improve community integration, and offering travel allowances to visit family and spouses (Godwin et al., 2016; Godwin et al., 2014). Professional isolation from colleagues may be addressed by providing good access to the internet and online dental forums. (Gray, 2016; Handal et al., 2010).

Allowing dental practitioners to work in both a public and private capacity from existing government dental practices was suggested to encourage more dental practitioners to rural and remote practice. The combination of public and private medical practice is widespread in Australia (Cheng et al., 2013).

Increasing government funding to allow existing rural dental practitioners to make improvements to their practices was suggested to encourage these resident dental practitioners to remain in rural and remote communities. Government funding schemes have been trialled in Australia and include: the Dental Relocation and Infrastructure Scheme (DRISS) (Health Workforce Queensland, 2016),the Child Dental Benefits Scheme (CDBS) (Biggs, 2012), the Queensland Voucher for public patients to see private dental practitioners (Queensland Government, 2014) and, the Voluntary Dental Graduate Year Program (VDGYP) which ended in 2015 (Dental Board of Australia, 2012) (See Appendix A attached for details).

A different solution to encouraging the recruitment of dental practitioners to work in remote locations is to target the dental practitioners who are looking to transition to retirement (Schoo et al., 2005). A dental fly-in fly-out private practitioner participant from this study described the scenario where metropolitan dentists who were planning to retire soon may look to work part-time or on a locum basis. Working as fly-in fly-out dental practitioners gives them a sense of adventure at the end of a long career and affords them the opportunity to do some work where it is needed and appreciated.

5.4.5 Improving interprofessional relationships

Better communication and stronger collaborations between non-dental primary care providers and oral health services may reduce the disruptions to oral health service provision and help reduce the frequency of problem presentations (Mouradian et al., 2004). In order to improve interprofessional

collaboration, several strategies have been suggested by participants including: having regular face-to-face meetings between the visiting or regional dental practitioners and the primary care providers, circulating the timetables of the visiting dental practitioners to the primary care providers prior to their visit to the communities, making the contact details of the nearby dental clinics available to the community primary care providers, having an oral health contact person in the community, establishing and maintaining effective communication and referral pathways, and a possible role for teledentistry which could facilitate more effective communication between health care providers and dental practitioners.

5.4.5.1 *Face-to-face meetings*

Creating opportunities for face-to-face meetings between visiting dental and rural primary care providers could improve the interprofessional communication and collaboration. Participants from all three case studies believed that if there was opportunity for the two groups to meet, this could help future collaboration and start building relationships. The interprofessional education and training requirements suggested in one study, proposed that hospital-based dentists be integrated into the health care teams for catastrophic events and disaster responses (Psoter et al., 2006). This educational program was designed to encourage discussion among dental and medical professionals about the roles of dentists in meeting human resource needs in emergency situations. These face-to-face meetings enable mutual respect and recognition for shared skill sets.

Dental and medical graduates from the second case study shared hospital accommodation and university experiences, and consequently also socialised with each other, which allowed for respect and relationships to be developed. The relative success of the informalities of the referral pathways for the oral health delivery structure examined in Case Study 2, where the dental practitioner worked in a clinic directly attached to the hospital, contrasted with the different situation from the Case Study 1, where the dental clinic was not attached to the hospital. In Case Study 2 hospital corridor meetings occurred between the professional groups and patient information sharing, although informal in nature, occasionally occurred.

5.4.5.2 *Establishing and maintaining effective communication and referral pathways*

It has been reported in the literature that establishing and maintaining effective two-way referral pathways between dental practitioners and primary care providers aids the establishment of better confidence in the management and prevention of oral health issues in rural and remote communities (Dyson et al., 2012). Similarly, in this research project it was suggested that dental practitioners should provide feedback on the patients referred by primary care practitioners. This enhanced communication would enable better patient outcomes for rural and remote patients and would inevitably result in fewer repeat presentations, as doctors would know if those referred

patients had attended the suggested dental appointments and the potential hospitalisations for medical conditions of dental origin may be decreased (Australian Institute of Health and Welfare, 2014a).

5.4.5.3 *Having a community based oral health contact person*

The lack of communication between dental and primary carers was sometimes associated with the lack of staff who were available to notify primary care providers about the visiting dental services. Participants reported that they were often unaware of the timetables or contact details of the visiting dental practitioners and it was suggested that the timetables should be circulated to the primary care providers prior to their visits.

In Case Study 1, a long term resident dental assistant served as the unofficial contact person to triage emergency dental appointments when the official referral pathway, the Central Referral Centre, was unsuccessful. In Case Study 2 a dental therapist participant who had been in the community for a long time, was known and trusted by the community as a contact person for most matters relating to oral health and they were seen to be able to facilitate earlier dental appointments than would be achieved through official channels.

In Tasmania, an oral health phone line triage system has been trialled utilising suitably trained dental receptionists to decide who should and should not receive urgent dental care, and to help these patients to communicate with other oral health practitioners for appointments for both problem-based and routine dental care (Ponnusamy et al., 2013). Participants from the current Queensland study however felt that a phone triage system would be of little benefit as the primary care network providers would still be unable to carry out any treatment suggested by the person answering the phone call.

The answer to the third research question provided several suggested strategies from participants from this study to improve oral health in their communities. These included: the provision of better preventative care, utilising existing non-dental primary care providers in dental emergency care, exploring alternative oral health service delivery models, increasing the dental workforce and, improving collaborative relationships between dental personnel and the non-dental rural primary care networks. The successful implementation of many of the above suggested strategies was reliant on increased oral health funding for both government-based and private-based dental care.

These strategies to improve access to oral health care were common across all three case studies however, each of the three oral health care delivery models examined had a different set of circumstances and the strategies needed to be tailored to each individual situation, as discussed in the next section of this thesis.

5.4.6 Strategies to improve oral health care access in each case study

The separation of the eight communities into three case studies was useful as the different oral health delivery models encountered specific challenges. This helped the candidate to organise the suggested strategies to the specific challenges identified within each group of communities.

5.4.6.1 *Case Study 1*

The Referral Call Centre Model with the toll-free number where patients or health care providers could leave a message to make an appointment to see the public dentist caused frustrations amongst referring non-dental primary care providers because they never received any feedback from the call centre. The referring health care providers received no feedback on the patients referred to the centre for treatment and complained that phone messages were not returned, and they only learned of the treatment outcomes when the patient returned to them with an unrelated medical issue. The suggested strategy to address this barrier was to encourage an organised referral protocol between dental and non-dental practitioners that involved written feedback from the treating oral health care practitioner. This is closely tied to the issue of improving interprofessional collaboration and is supported in the literature (Dyson et al., 2012; Gussy et al., 2006).

Changes to the organisational arrangements of the Central Referral Centre were not well explained to the rural primary care networks with providers expressing their confusion as to the availability of services and the requirements to access these services. Again, the strategy to address this would be to establish a clear referral pathway. The process for notification of the arrival of a visiting dental practitioner to the community was informal in nature and was consequently a significant factor in the inability to formulate effective referral pathways and emergency appointment scheduling. The establishment of a formal notification process of oral health service provision times would improve the effectiveness of the oral health service in the first case study.

The Central Referral Centre was a further frustration when immediate assistance with a dental emergency patient was needed by non-dental primary care providers as the call centre was often not attended by an operator but only allowed a message to be left. The operator, when present, did not have any dental training and did not have the ability to accurately triage dental appointments. The strategy to improve this situation would be to have the call centre attended 24/7 by someone with appropriate oral health care training. This was discovered to be an effective triage method for patient self-referral in a study from Tasmania where telephone answering staff were given appropriate oral health training to manage effective triaging (Ponnusamy et al., 2013).

In many emergency situations the “official” referral pathway was bypassed, and instead direct contact was made with the hospital dental assistant who was well liked, approachable and respected

as the person to approach to directly access dental treatment. This strategy to facilitate effective oral health care access by establishing a long-term local community resident with dental triage knowledge as a non-official contact or 'lynch pin" person in the community was an efficient way to gain direct access to dental appointments.

5.4.6.2 *Case Study 2*

The second case study with the directly contactable government dental practitioner reported fewer frustrations than in the first case study because non-dental primary care providers were able to contact the dentist directly if they needed advice. However, this government dental practitioner was rarely contacted, and he believed that professional segregation existed between dental and medical practitioners. A strategy to address this would be to encourage interprofessional collaboration with regular meetings between the members of the non-dental primary care networks and this dental practitioner. These meetings could be face-to-face or via teleconferencing. The broader suggestion is to offer more effective interprofessional education at university level to encourage the establishment of mutual interprofessional respect (Stans et al., 2013; Tenenbaum et al., 2008). Several participants in this study suggested the inclusion of oral health care practitioners into comprehensive medical treatment planning sessions perhaps using dental technologies and telecommunications. The literature supported this finding where interprofessional treatment planning was shown to provide an understanding of, and respect for, the roles of members of different professions in the health care team (Boyce et al., 2009).

Long waiting times were reported for the government dental list in this second case study and the lack of a consistent school dental service was also reported. This community addressed this issue by actively recruiting dental practitioners before graduation from university. The strategy for this oral health care model is to offer incentives such as mentors, financial incentives and lifestyle factors (Godwin et al., 2014). A compulsory rural rotation for new dental graduates was suggested as a strategy to increase the rural dental workforce. This has now occurs with the University of Queensland dental students placed on rural rotational in an Indigenous oral health clinic in one of the communities from Case Study 1 (Bradfield, 2016).

Due to the shortages of private dental practitioners in the community, a suggested strategy was to offer government dental practitioners the rights to practice in a shared private and government practice capacity to increase the effectiveness of existing oral health care services (Carlisle et al., 2017), as already happens in medical practice (Banda et al., 1994; Johannessen & Hagen, 2014). People without a Health Care Card are not eligible for treatment at a hospital dental clinic and consequently a large proportion of the residents from their communities were unable to access timely oral health care. Upskilling the primary care network in emergency dental techniques would

utilise existing non-dental primary care providers in an oral health care capacity to help address the oral health needs for this second case study. Upskilling of primary care providers has been recommended in the literature to build interprofessional relationships (Crocombe et al., 2014; Manahan et al., 2011; Mouradian et al., 2003).

The vast distances that patients were required to travel to access care from the public dentist in this second case study posed difficulties for rural and remote residents. These patients needed to take time off work, make child care arrangements, and pay for fuel and accommodation. The second case study suggested the need for the government dental practitioner to work from a mobile dental unit that could travel to outreach centres and consequently alleviate the difficulties associated with oral health care access for patients. Mobile dental units have been shown to be an effective model for oral health care delivery in other parts of the world (Ganavadiya et al., 2014). These mobile dental units also have some limitations, as has been demonstrated in this research project. Additionally, the facilitation of transportation for patients to the dental clinics was suggested by participants. A suggested strategy that has been implemented in this case study was that local councils, community services and charities sometimes provided funding for transportation from these remotely located communities to oral health care services.

5.4.6.3 *Case Study 3*

The oral health service delivery model offered by the NGO MDS was widely appreciated by the non-dental primary care network as patients who were not means tested, could be referred to them for treatment who were not means tested. This essentially facilitated a much needed service for the "working poor" in the communities, those without either a Health Care Card or private dental funding. The strategies to improve access to this service were consequently often specific to the nature of this service.

The frustrations for this service were often in relation to logistical issues surrounding the physical movement of the 18-wheler semi-trailer truck. These issues included poor road conditions ,tele-communication inadequacies, time restraints put on community stays, and dental supply delivery difficulties. Strategies to address these issues were reliant on more complex solutions such as improving road conditions, improving internet and telephone services, and providing reliable solid three phase power supplies.

Participants reported long waiting lists to access treatment from the NGO MDS due to non-discrimination towards private cover or Health Care Card holding status. A strategy to address this issue would be to limit the service to those without a Health Care Card, as these patients are able to access free treatment from public dental practitioners. The non-sharing of dental records between

these service types also meant that treatments were often not co-ordinated properly and some patients were being over or underserviced. The facilitation of better intra-professional communication with other oral health services record sharing would be a strategy to improve this oral health delivery model.

Time limits when visiting communities meant that only the emergency dental treatments were often addressed. Extending these visits past the two week cut-off time would allow preventative oral health care to be implemented in those communities which might facilitate a more effective form of oral health care service rather than a "band-aid" type of care. The necessity to have experienced dental practitioners rather than new dental graduates was suggested as an important strategy for effective service provision due to the complex nature of some emergency dental treatments. The promotional activities associated with the NGO MDS were seen as an excellent strategy, that was improving oral health awareness in rural and remote Queensland. The strategy to provide additional mobile units or fly-in fly-out models of this service that would increase service provision to communities was supported in the literature (Ganavadiya et al., 2014).

Private dental practitioners sometimes felt threatened by this service and felt that it posed professional competition for the limited rural dental patient population and threatened the financial viability of their established rural and remote practices. Better communication with existing oral health care providers would mean that more effective travel routes might be established that specifically addressed those communities in need. Funding uncertainties for the continuation of this service exacerbated these concerns. If this philanthropic service ceased then established dental practices may have been forced to close in the meantime and the rural and remote dental patients ultimately suffer this loss.

5.5 Research Question Four

The final research question aimed to discover the interest by both dental and non-dental care providers in the use of dental technologies such as intraoral cameras (teledentistry) and the introduction of dental consultations into existing telehealth pathways to better manage dental issues in rural and remote regions.

5.5.1 Teledentistry/Intraoral cameras

The majority of the non-dental participants from this study did not believe that the introduction of intraoral cameras to medical practices would be an effective mechanism to improve the outcomes for patients with dental issues. In the opinion of those participants, the introduction of these new technologies to rural communities in outback Queensland would require regular training to be

provided to primary care providers and protocols would need to be put in place for such technologies to be regularly serviced and maintained. Couple this training burden with the unreliability of the broadband width to the rural and remote communities examined, and this study found that the non-dental participants generally felt only limited value for the use of the intraoral camera technology as a way to explore a broader, cross-disciplinary role for teledentistry.

The dental participants interviewed similarly did not think that the investment in expensive technologies such as intraoral cameras would help improve dental outcomes for patients in any significant way, as they maintained that non-dental primary care providers did not have the necessary skill set or equipment base to offer effective dental treatment.

The introduction of these technologies, however, was seen as a more useful tool for dentist to dentist communications to alleviate professional isolation from dental colleagues and to allow professional mentoring for new dental graduates. This finding was substantiated in the literature that demonstrated support for the role that teledentistry with intraoral camera technology had in education, reduction of the isolation felt by rural dentists, and in communication within professional organisations (Bauer & Brown, 2001). Teledentistry applications are also reported in other international studies around the world as a suitable mechanism for enhancing interprofessional communications between dentists themselves, or between dentists and other dental specialists (Yoshinaga, 2001).

It is reported in the literature that enabling live videoconferencing in conjunction with the use of an intraoral camera, is a more complicated procedure, as it is necessary to use a standalone IP/ISDN or to install a PCI codec board into the system. If a live group session is necessary, a multipoint control unit that connects three or more parties is necessary but the codec must be able to accommodate audio and visual functions (Folke, 2001). Some non-dental health care participants suggested that an alternative, more simplified teledentistry technique using emailed images, taken with normal cameras or Smart Phones, could achieve similar results as direct streaming with intraoral cameras, for a fraction of the cost. This technique has also been reported in the literature as being another successful option for remote patient consultations in other parts of the world (Fricton & Chen, 2009). This technique would not require extensive training in new technologies, other than the ability to use the already established telehealth pathways between hospitals in rural and remote communities. This “store-and-forward” technology, uses an image that is taken at one time, and sent at a later time that is convenient to the parties involved. This type of data transfer provides excellent results for most dental applications, without excessive costs for equipment or connectivity. The intraoral image would need to be captured ahead of time, using either a Smart Phone or a suitable digital camera. To store an image, it is necessary to have a computer with specific

capabilities which include: a substantial hard drive memory, adequate RAM, and a speedy processor. To forward the image to the off-site dental practitioner it would be necessary to have a modem, and a suitably powerful and reliable Internet connection. (Birnbach, 2000; Chang et al., 2003).

The possible applications for teledentistry were reportedly misunderstood and underutilised in other Australian studies (Mariño & Ghanim, 2013). The non-dental respondents from this research project generally appreciated the potential of this new technology and the rationale for its use, however they were unsure of the cost benefits and the subsequent uptake of such technology by busy practitioners. The dental care providers on the other hand were sceptical as to the usefulness of an emailed or texted photo to help in dental disease diagnosis. Dental participants described the necessity for a "hands on" approach for dental diagnosis, and they suggested that even if they were able to diagnose the issue, the medical practitioners would not have the equipment or skillset to offer definitive treatment. The literature suggests that the implications for the successful utilisations for teledentistry are rapidly progressing and are largely dependent on high speed internet connections (Chen et al., 2003; Jampani et al., 2011). The arrival of the National Broadband Network into rural and remote Queensland regions, with quicker Internet and broadband high-speed connections, was eagerly awaited by participants from this study, as this could potentially enable teledentistry to be a more substantial possibility. As evidenced in the literature, other rural locations around the world already enjoy the remote consultation choices that teledentistry offers to rural and remote residents, in the absence of an easily accessible dental practitioner (McLaren & Kopycka-Kedzierawski, 2016; Petcu et al., 2017).

5.5.2 Teleconferencing with dental professionals

According to the majority of non-dental health care provider participants in this study, the possibility of using remote dental consultations across already established telecommunications networks to triage dental appointments, without using dental technologies such as intraoral cameras, was a more useful consideration. The potential for the utilisation of simple technologies in remote dental consultations was reported in the established literature as a mechanism to allow General Medical Practitioners to have consultations with an off-site dental practitioner. This would potentially improve care for patients and help reduce the costs and emotional burdens for patients for travelling to regional centres for dental care (Khan & Omar, 2013). However, the inclusion of dental consultations in this form of interprofessional collaboration did not occur in any of the three case studies examined in this research project.

The members of the primary care networks interviewed described instances where they already include other allied health care providers, or specialist medical practitioners in teleconferencing

chronic care planning sessions for rural and remote patients. Telemedicine consultations around the world already combine digital technologies with the Internet and other forms of telecommunications to provide remote health care access to rural areas (Zimlichman, 2005). Other medical specialities including psychiatric, cardiac and dermatology specialities often use these forms of technologies for remote consultations (Klaz et al., 2005)

Most of the dental personnel from this study agreed that their inclusion in teleconferencing meetings regarding patient care was described as “nice in theory” but the dental workforce shortages and time constraints associated with dental visits, often meant that it would be impractical to schedule meeting times that might be mutually convenient for the two professional groups. It is surmised that the siloed natures of the professional groups often may be detrimental to patient outcomes. Although the interviewed dental practitioners generally did not see the value in including dental practitioners in medical teleconferencing, the dental practitioners did see the value of post graduate education delivery to dental practitioners in rural and remote locations via webinar presentations. These education sessions, that already occur throughout rural and remote Queensland, are accessible as pre-taped lectures or as interactive discussions where remote practitioners may ask questions and participate in online discussions (Australian Dental Association, 2013)

5.6 Review of the Conceptual Framework

The conceptual framework formulated at the beginning of this research project anticipated that a relationship would exist between the non-dental primary care providers in each of the eight communities and the dental personnel who serviced these communities. It was postulated that this relationship would allow effective inter-professional collaborations which would in turn contribute to better medical and dental outcomes for the residents living in these rural and remote communities (Figure 5.1).

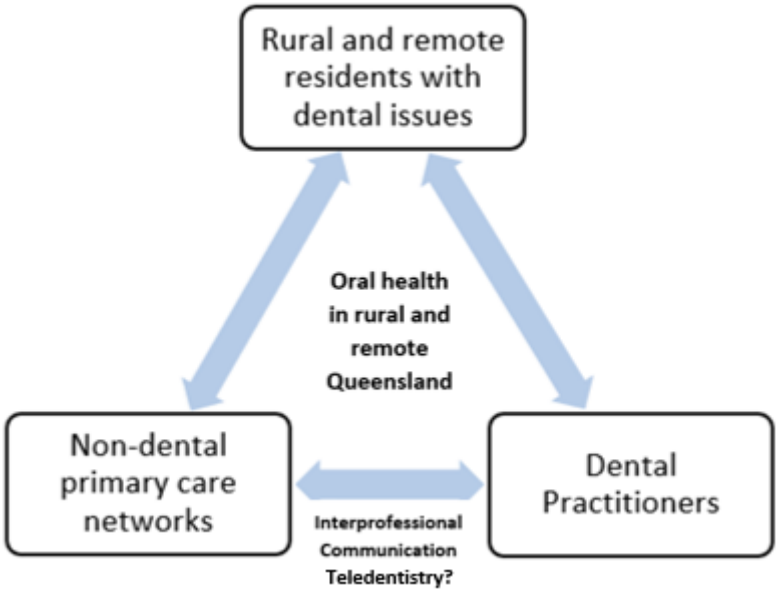

Figure 5.1: The original conceptual framework before data collection

Findings from the data collected however suggest that often some of the links and associations between the primary care providers, the dental personnel and the residents in the study sites were weak and, in some communities, even non-existent. This has been shown by the broken lines in the revised conceptual framework diagram below (figure 5.2). In addition, the new conceptual framework integrates four areas where the strategies that were suggested by the interviewed primary care participants to improve oral health care are grouped. These strategies are multifaceted and are directed toward improving communications between the three key groups (rural and remote residents with dental issues, dental practitioners and non-dental primary care providers).

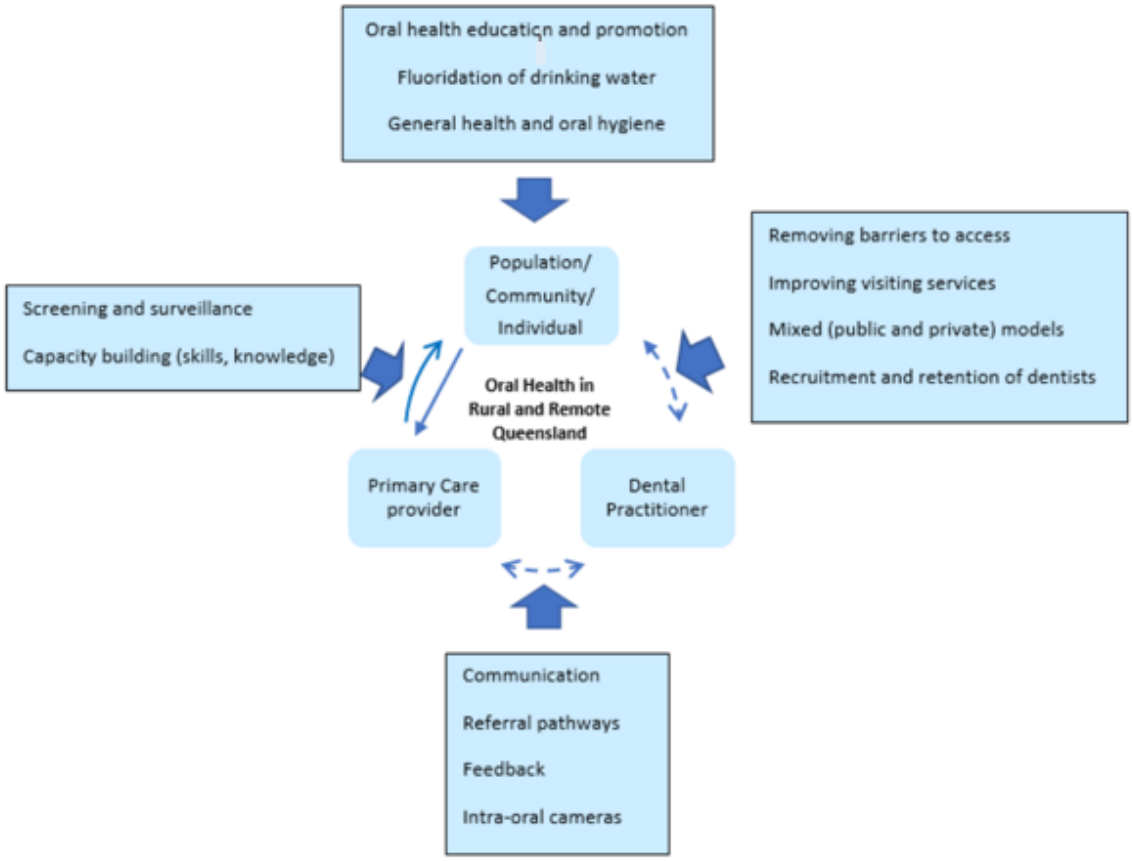

Figure 5.2: Modified Conceptual Framework demonstrating broken lines in communication.

5.7 Summary

This chapter discussed the results from the three case descriptive studies which examined three different models of oral health care delivery in eight rural and remote communities. Fifty-five non-dental primary care providers and 12 dental participants were interviewed by either face-to-face interviews in the field or by telephone interviews. The aims of the study were considered, and the answers to the four research questions were thematically analysed and then discussed, in relation to existing literature to develop a picture of the situation in relation to oral health care provision in rural and remote Queensland.

The methodological approach was revisited during this research project and as the findings emerged the division of the eight communities into three descriptive case studies with different models of oral health care delivery became a suitable way to present the findings. A thematic analysis of the findings showed that there were common challenges to effective oral health care and the strategies

to address these issues were common among the eight rural and remote communities, and some challenges were discovered to be site/circumstance-specific. There is not one main solution to addressing the difficulties associated with rural and remote oral health care but instead some strategies might be effective in some communities and not in others. Consequently the separation of the findings into case studies allowed for better analysis.

The oral health of the residents included in the three case studies was reported by the participants to be generally poor. The members of the non-dental primary care networks reported frequently seeing people from their communities with dental issues and they generally felt ill-equipped to deal with dental issues.

Overall the barriers to effective oral health care access were related to dental workforce shortages, relative costs of dental treatments and the lack of oral health awareness of community residents.

The challenges to effective oral health care delivery were specific to each of the three oral health delivery models discussed. Challenges specific to the Central Referral Centre in the first case study related mainly to interprofessional communication difficulties which included: the lack of ability for primary care providers to engage in personal conversation with the dental care provider for immediate dental care advice, the lack of an experienced person to answer and triage dental emergencies, and the lack of feedback that patients had been attended to.

Challenges specific to the directly contactable government dental practitioner model in the second case study included: long waiting lists, the inability for some patients to travel the long distances to the dental clinic and, the government dental practitioner's inability to travel to them.

Challenges specific to the philanthropic oral health service provided by the NGO MDS in the third case study included: issues in relation to the logistics of moving the large mobile dental clinic around rural and remote Queensland, cultural sensitivity issues with Indigenous people's mistrust for the imposing truck and, time restraints.

The second research question examined the nature of interprofessional communications. In all of the case studies, there were limited interprofessional relationships between dental practitioners and the non-dental primary care networks, but were dependant on the specific network members. General Medical Practitioners and pharmacists reported generally poor relationships, which were a result of the transient nature of these predominantly locum employed practitioners. The historically siloed natures of these professional groups also contributed to poor interprofessional relationship building. The Directors of Nursing and organisational hospital staff, who were often long-term residents of the areas studied, more often formed good relationships with visiting or regional dental practitioners.

The third research question asked what strategies were suggested to improve the provision of oral health services to the communities. The strategies suggested by all three case studies included: increasing preventative oral health strategies such as oral health promotional activities and water fluoridation, and building the capacity of non-dental primary care providers to provide oral health care. Other strategies proposed were to provide alternative dental service delivery models such as mixed public and private dental practice, increased utilisation of other oral health care provider types, and the better utilisation of dental undergraduate students. Methods to improve the oral health of people in these rural and remote communities included encouraging the recruitment and retention of the entire dental workforce and improving interprofessional relationships.

The different oral health care delivery models in the three case studies had specific suggested strategies to improve their mode of delivery. Strategies to increase the effectiveness of the oral health delivery model specific to the Central Referral Centre in the first case study were to improve interprofessional communications, establish feedback protocols from dental services for received dental referrals, provide formalised notification of arrivals for the dental practitioners when in the community, and provide dentally experienced phone call operators, or to encourage the establishment of an official contact person for emergency dental triage appointments.

Strategies to increase the effectiveness of the oral health delivery model specific to the directly contactable government dental practitioner model in the second case study were to encourage interprofessional collaborations by including the dental practitioner in comprehensive treatment planning sessions, decrease waiting lists in the public clinic by recruiting more dental workforce members, to offer dental practitioners the ability to practice in a dual capacity in both government and private practice, and to establish small mobile dental units to travel to outreach centres.

Strategies to increase the effectiveness of the oral health delivery model specific to the philanthropic oral health service provided by the NGO MDS in the third case study included: limiting service provision to those who do not possess a Health Care Card, enabling the sharing of dental records across the oral services, extending the amount of time spent in each community to facilitate the preventative stage of treatments, increasing the number of mobile dental units and, establishing funding certainty for continuation of the philanthropic service.

The final research question asked about the interest in dental technology to enhance this interprofessional communication. Including dental consultations into already established telehealth conferencing treatment planning sessions to enable effective patient treatment planning was discussed as this already happens with other allied health care providers. The introduction of intraoral cameras into medical practice however was seen as less viable by both dental and non-

dental primary care providers because clinical treatment would still need to be performed in a dental clinic situation and non-dental primary care providers don't have the necessary skills or equipment to provide definitive oral health care. Other factors that limited the acceptance of this teledentistry approach to oral health care included the internet restrictions in rural and remote Queensland areas, cost of the equipment and the training needs of participants. The responses to this question were similar across the three case studies.

The following chapter concludes this thesis and will discuss the significance of this research. It will offer a comprehensive series of recommendations to address some of the oral health issues that are specific to oral health issues in the eight rural and remote Queensland communities examined. The results of the three case studies that received oral health care via different delivery models show that there is not one simple solution to the problem of effective oral health care delivery and that some recommendations may work in some communities but not in others. These recommendations have been supported by findings in the literature and may be of relevance not just to the communities studied in this research project, but likely also to those communities in many other rural and remote areas.

Chapter Six: Conclusion

"Reasoning draws a conclusion, but does not make the conclusion certain, unless the mind discovers it by the path of experience." Roger Bacon (English Philosopher born 1219 and died 1292)

The aims of this research project were to study the provision of oral health services to people living in eight rural and remote Queensland communities, to examine the extent to which oral health problems impacted on service provision by non-dental primary health care providers, and to examine the specific challenges and solutions to service provision by three different models of oral health care delivery service that existed in rural and remote Queensland. The nature of interprofessional communication between dental and non-dental primary care providers in these communities were explored.

A summary of the findings from the literature review in relation to each of those four research questions is presented in this final chapter in the thesis. The strengths and limitations of this study are presented and the gaps that were identified in the literature review are addressed. An "ideal" model of oral health care delivery will be hypothesised which encompasses the best aspects of each of the three different oral health care delivery models examined. Finally, how findings have been disseminated to a wider audience along this long research journey is explained and further directions for ongoing research are identified.

6.1 Summary of Findings in relation to the literature review

This findings of this research project support the literature by demonstrating that residents living in the eight rural and remote Queensland communities examined appear to have poor oral health and limited access to timely oral health care services. Indigenous people have some of the poorest oral health in Australia and this is supported by the findings from this research project that report the intermittent nature of Indigenous specific oral health services to these communities. Residents in these communities often present to the non-dental primary health care network with dental issues in the absence of a resident dental practitioner and these health care providers often lack substantive training in the management of emergency dental presentations.

The funding arrangements for oral health services in Australia are reported in the literature to be organised in several ways. Government oral health services are accessible for eligible patients with

health care cards, Indigenous oral health services, school dental services for school aged children, private oral health care is self-funded by patients with or without private health insurance, and via philanthropic oral health services. This research project groups the communities into three case studies that each explore a different model of oral health delivery. The case studies investigate two different models for government oral health services and a philanthropic mobile dental service.

The interest of both dental and non-dental primary care providers is gauged, in the use of a dental technology to enhance interprofessional communication. The literature review indicates that this technology consists of intra-oral cameras that capture images of dental structures inside the mouth to be transmitted via telecommunication pathways for remote diagnosis by dental practitioners (teledentistry). This use of dental technology has been trialled in other parts of the world to facilitate oral health triage advice for rural and remote residents in the absence of a resident dental practitioner. Teledentistry is a relatively new phenomenon in Australia and the applications for its efficacy and usefulness in rural and remote Queensland medical practice is evaluated.

The separation of the findings into the three case studies evolved as the thematic analysis of interviews with 12 dental and 55 non-dental primary care providers revealed three different models of oral health care delivery. Case Study 1 and 2 examined the way in which those groups of communities received oral health services from the public dental system and Case Study 3 examined how some of the communities also received oral health services from a philanthropic NGO mobile dental service. The interviews took place between 2015 and 2017 in eight rural and remote Queensland communities who had no resident dental practitioner but had an active primary care network.

The answers to the four main questions are summarised below.

6.1.1 RQ1: What are the barriers and challenges to effective oral health care provision and access in the eight communities studied?

The challenges and barriers to oral health and the strategies suggested to improve oral health care delivery in the eight rural and remote Queensland communities are summarised in Table 6.1. The specific barriers and challenges to workforce shortages and strategies to increase the oral health workforce are summarised in Table 6.2. The barriers and challenges to oral health delivery models and strategies to improve oral health care service delivery for each of the three case studies are summarised in table 6.3.

Table 6.1: Barriers and challenges to oral health and strategies to improve oral health care service delivery in rural and remote Queensland.

Barriers and challenges	Strategies
• Workforce shortages	• Increase the oral health workforce
• High costs of accessing oral health care	• Increase government funding
• Lack of oral health awareness and lack of oral health promotion	• Educate patients about the interconnection between oral and medical health.
• Poor oral health preventative strategies.	• Provide preventative oral health care
• Underutilisation of non-dental primary care providers	• Build the capacity of non-dental primary care providers.
• Poor interprofessional collaboration	• Improve interprofessional relationships
• Indigenous Oral Health Care Service Challenges	• Establish increased service provision

Table 6.2: Barriers and challenges to oral health workforce shortages and strategies to increase the dental workforce

Oral Health Workforce Shortages	
Barriers and Challenges	**Strategies**
• Government funding restraints • The lack of alternative business models • High operative costs for private dental practice. • Population bases too small for economic viability for private dental practice. • Lifestyle factors for dental practitioners • Professional isolation from colleagues. • Professional competition with visiting oral health services.	• Increase government funding. • Allow dentists to work in both public and a private capacity. Compulsory rural rotation for dental students. • Encourage older experience dental practitioners to transition to retirement with a period in rural practice. • Encourage recent dental graduates to practice rurally and offer incentives such as professional mentoring with a possible role for teledentistry, remuneration, accommodation, schooling for children, and travel allowances.

Table 6.3: Barriers and challenges to oral health delivery models and strategies to improve oral health care service delivery for each of the three case studies

Case Study One	
Barriers and Challenges	**Strategies**
• No feedback from call centre re patient's treatment.) • Inexperienced phone receptions with limited oral health training. • Poor notification of dentist arrival in communities. • Lack of interprofessional collaboration.	• Encourage an organised referral protocol between dental and non-dental practitioners.) • Establish a formal notification process of oral health service provision times. • Provide appropriate oral health care training for call centre operator staff.) • Establishing a local community resident with dental triage knowledge as a non-official contact person. • Encourage and support the continuation of the school dental service and Indigenous oral health services.
Case Study Two	
Barriers and Challenges	**Strategies**
• Recent graduate government dental practitioner challenges which included lower levels of experience in recent graduates and the difficulties associated with the limitations of broader practice experience availability, isolation from professional peers, and lifestyle factors. • Long public dental waiting lists. • The necessity for patients to travel long distances to access care. • The expenses for patients associated with this travel. • The difficulties associated with expectations of 24/7 cover for dental emergencies.	• Encourage regular interprofessional collaborative meetings which could be either face-to-face of by teleconferencing. • Actively recruit new dental graduate dental practitioners from Universities. • Encourage a compulsory rural rotation foe dental students. • Offer alternative models of oral health delivery such as a mixed public and dental practice model. • Establish mobile dental units. • Encourage and support the continuation of the school dental service and Indigenous oral health services. • Upskill the non-dental primary care networks in oral health knowledge. • Facilitate transportation for patients to travel to dental clinics.

Case Study Three	
Barriers and Challenges	**Strategies**
• Logistical issues relating to poor road conditions which made it difficult to access some remote regions. • Limitations in telecommunications. • Limitations in the types and complexities of oral health care options able to be offered due to time restraints. • Professional competition with existing dental practitioners in the regions. • Exploitation of the system by opportunistic patients. • Continuation of funding uncertainties and the inability to offer continuity of patient care.	• Complex solutions to improve logistics such as improve road conditions, telecommunication networks and power supplies. • Limit the services offered to people without a health care card. • Encourage sharing of dental records from government clinics. • Extend visiting times past the two week period to allow preventative care as well as emergency treatments. • Employ experienced dental practitioners rather than recent graduate dental practitioners. • Increase the number of mobile dental units. • Improve communication with existing dental practitioners in the regions visited. • Establish reliable funding for continuation of the oral health service.

6.1.2 RQ2: What is the relationship that exists between dental practitioners and the non-dental primary care network?

The nature of the relationships between non-dental and dental health care practitioners in the regions examined are generally described as “poor at best” and often “non-existent”. This is attributed in part to high staff turnovers and the transient nature of locum medical practitioners and pharmacists, which hinders the ability to form professional relationships with oral health care providers. The siloed behaviours of both the dental and non-dental care providers in the Queensland communities examined, further contributes to the divide that exists between oral health and medical health, even though the literature supports the interconnectivity between oral and overall medical health.

6.1.2.1 *The relationship with government oral health service providers.*

The relationships between non-dental primary care providers and government dental personnel are very poor for the first case study where the 1800 Central Referral Call Centre was the main source of contact. Consequently, an alternative dental "lynchpin" person was unofficially established which reinforced the conclusion that direct contact between the two professional groups enables better patient outcomes. The ability for referring non-dental health care providers to make direct contact with a government dental practitioner allows for better interprofessional relationship formation. More effective patient care occurs if the dental care provider is directly responsible for appointment triaging and available to offer immediate oral care advice over the phone.

6.1.2.2 *The relationship with private dental practitioners*

The relationships between the non-dental primary care networks and fly in fly out private dental practitioners are also almost non-existent due to the short periods of time that these itinerant providers have in the communities. The long term private dental practitioners in nearby hub communities describe only rare occasions of personal contact with members of the non-dental primary care networks perhaps again due to the siloed professional attitudes that exist between medical and dental practitioners.

Some members of the primary care team do however describe good relationships with regional private dental practitioners in capital cities who they sometimes consult for oral health care advice and who are often their own personal dentists. Residents from rural and remote communities consequently include dental appointments in holiday plans when they visit regional centres and these patients often prefer to continue their long term dental relationships with the dental practitioners that they used to attend before moving to the rural and remote communities examined.

6.1.2.3 *The relationship with the NGO Mobile Dental Service (MDS) dental personnel*

The dental personnel on the NGO MDS developed the most effective relationships with the non-dental primary care networks. The best communications are reported to be with hospital administration staff and Directors of Nursing who are often long-term residents in the communities. This is due to the necessity of the NGO MDS personnel to organise logistical arrangements for the arrival of the unit into the communities. The interprofessional relationships with General Medical Practitioners and pharmacists, however, are concluded to be poor due to the relatively short periods of time that the mobile service is in the community and the high turnover of medical staff in those communities. The locum natures of employment for rural and remote doctors and pharmacists, where they typically stay in the communities for two to three months at a time, did not provide enough time to establish good interprofessional relationships.

Government oral health care practitioners established good relationships with the dental personnel from the NGO MDS. The governmental dental practitioners are very busy with large waiting lists and limited staffing resources and they welcomed the help from this free service.

Conversely, the private dental practitioners have more reserved relationships with the oral health care providers on the NGO MDS. The established rural dental practitioners perceive the philanthropic mobile dental service as professional competition. The economic success of their private practices relies on a certain population base of dental patients for economic viability. If patients leave these existing private dental practices, to visit the philanthropic mobile dental service then they may need to close their private dental practices down and move back to the cities. The conclusion from these established dental practitioners, and the fly-in fly-out dental practitioners is that the free mobile service may ultimately be a bad thing for rural and remote communities if the service faces long term sustainability issues.

6.1.3 RQ 3: What strategies have been suggested to improve oral health in the rural and remote regions examined?

Participants detailed a number of strategies that could contribute to better oral health care in all eight of the communities examined. These strategies have been previously outlined in Table 6.1, Table 6.2 and Table 6.3.

6.1.4 RQ4: What is the level of interest in utilisation of technology by non-dental practitioners and dental practitioners in management of dental problems?

The Interest in the introduction of intraoral cameras to medical practice to transmit dental images to a remotely located dental practitioner for triage and advice is varied. However, the inclusion of dental practitioners into teleconference-type treatment planning meetings along existing telehealth pathways is generally accepted to be a good idea.

More than half of the non-dental primary care network participants conclude that the introduction to medical practice of intraoral cameras to transmit dental images to a remotely-located dental practitioner for triage and advice, is not an effective mechanism to improve the outcomes for patients with dental issues. The barriers and challenges for the use of intraoral cameras in medical practice for remote diagnosis of dental issues (teledentistry) and strategies to utilise this technology are summarised in Table 6.4.

Table 6.4: Barriers and challenges for the use of intraoral cameras in medical practice for remote diagnosis of dental issues (teledentistry) and strategies to utilise this technology.

Teledentistry	
Barriers and Challenges	**Strategies**
• The costs of the associated equipment. • Maintenance issues for this equipment. • Time needed to train staff to take the images and transmit them. • The unreliability of the telecommunication networks to support the technology.	• National Broadband Network in 2020 may support teledentistry but this will need to be established into the future. • Including dental consultations into existing telemedicine pathways for chronic care patient collaborations with a possible future role for intraoral camera imaging and teledentistry.

The remaining group of non-dental participants interviewed express great interest in the potential for the technologies *into the future*, as they can see the possible benefits in relation to improving interprofessional collaborations with dentists. Dental participants conclude that they do not believe that a transmitted dental image from an intraoral camera will help rural and remote patient outcomes, as they perceive that the non-dental primary care providers do not have the necessary skill set or equipment base to offer effective dental treatment.

The non-dental primary care network generally agree that the future inclusion of the dental practitioner in the health care planning team for chronic care patients using existing telemedicine conferencing sessions, is an important step to improving patient health care outcomes. The government dental practitioners agree that their inclusion in telemedicine consultations for chronic care patients is a good idea but the other types of dental practitioners, from fly-in fly-out private practice or from the NGO Mobile Dental Service, conclude that they do not stay in the communities long enough to commit to be able to fit into the specific times scheduled by hospital departments for these telemedicine meetings.

The most effective use for intraoral camera technology is concluded to be as a dentist to dentist communication mechanism, for post graduate education, intraprofessional communications, and as a mentoring tool for new dental graduates.

6.2 Recommendations

The following recommendations from the results of this study will improve oral health service delivery to the eight communities in this research. The implication is that these recommendations may inform policy and practice improvements to oral health service, in other rural and remote communities, in line with the National Oral Health Plan 2015-2024 which recognised rural and remote residents as being a population group who experience poorer oral health than other Australian people (Oral Health Monitoring Group, 2015). The recommendations include:

1. Increase the dental workforce.
2. Build the capacity of non-dental primary care providers.
3. Provide alternative dental service delivery models.
4. Provide preventative oral health care.
5. Improve interprofessional relationships between non-dental rural primary care networks and oral health care providers .

It is hoped that the following recommendations may help the relevant organisational bodies to address the issues identified by this study in association with the poor oral health of people living in outback Queensland communities. Each of the recommendations is discussed in more detail below.

6.2.1 Increase the dental workforce

Recruit oral health care providers including; dentists, oral health therapists, dental hygienists, dental therapists, dental technicians and dental assistants. Strategies to recruit and retain dentists include:

- Compulsory rural rotation for dental students.
- Encourage older experience dental practitioners to transition to retirement with a period in rural practice.
- Encourage recent dental graduates to practice rurally and offer incentive such as professional mentoring with a possible role for teledentistry, remuneration, accommodation, schooling for children, and travel allowances.
- Allow dentists to work in both public and a private capacity.
- Increase government funding.

6.2.2 Build the capacity of non-dental rural primary care practitioners

Utilising the existing non-dental primary care providers in the communities and upskilling them in basic oral health care provision. Recommendations to achieve this include:

- Offer non-dental primary health care students basic oral health education and training during their undergraduate training.

- Introduce post graduate oral health education as part of the induction process for General Medical Practitioners and other non-dental primary care providers before they begin working in rural and remote regions.

The ways to better utilise non-dental primary care providers included:

- Introduce mandatory oral health screening and education, such as diet and oral hygiene importance, into general medical health screening appointments.
- Utilising child health nurses and teachers for oral health promotion and education programs.
- Educating Indigenous Health Care Workers in basic preventative oral health.
- Including dental consultations into existing telemedicine pathways for chronic care patient collaborations with a possible future role for intraoral camera imaging and teledentistry.

6.2.3 Provide alternative dental service delivery models

Alternative service delivery models will improve access for residents to oral health services. Recommended alternative service delivery models include:

- A mixed model of government and private dental practice.)
- The increased utilisation of auxiliary oral health care providers such as dental therapists and hygienists.
- Providing mobile dental clinics.
- Transporting patients to dental clinics.
- The greater utilisation of undergraduate dental students.
- School dental services.
- Indigenous oral health care services.
- NGO Mobile Dental Services.

6.2.4 Provide preventative oral health care

Recommendations to improve the provision of preventative oral health care in the rural and remote communities examined include:

- Increase oral health promotion by educating about good oral hygiene techniques, diet for good oral health and the interconnection between oral and medical health.
- The provision of free tooth brushes to communities in need.
- Water fluoridation.

6.2.5 Improve interprofessional relationships

It is concluded from this study that improving the interprofessional relationships between dental practitioners and the non-dental rural primary care networks is necessary to provide more successful

overall health outcomes for rural and remote residents. Recommendations on how to improve this interprofessional communication include:

- Establishing standardised two-way referral pathways.
- Having regular collaborative meetings either face-to-face.
- Increasing awareness of the dental services available in the region.
- Establishing interprofessional education at university level.
- Establishing a person in the community to act as the unofficial 'lynch pin' to access oral health services directly when official referral pathways fail.

6.3 Specific Recommendations to improve the oral health care access for each oral health care delivery model from the three case studies

The recommendations to improve oral health and oral health care access in the eight communities are not applicable to all the problems identified. For this reason the research project is organised into three case studies that examine the issues specifically relating to three different oral health delivery models within the eight communities. The specific recommendations to improve oral health care delivery in each of the three case studies is summarised in Table 6.3.

6.4 Recommendations in relation to applications for dental technologies currently.

The applications for the introduction of intraoral cameras to medical practice to more effectively manage oral health issues are limited at this time in the eight rural and remote communities examined. This reasons for this are the significant costs associated with equipment and maintenance. time issues in relation to staff training, the unreliability of the telecommunication networks, and the inability for medical practitioners to act on definitive treatment advice due to lack of dental training and lack of dental equipment make it unfeasible to introduce these technologies to medical practice.

The introduction of dental consultations into patient chronic care treatment planning session via existing teleconferencing telecommunication pathways, is however recommended.

6.5 Significance of the research

This study contributes to the body of knowledge in several ways. This research investigated the nature of oral health delivery services to eight rural and remote Queensland communities that have

not been previously examined. The reviewed literature on the difficulties associated with oral health service access in rural and remote communities, suggest that people in rural and remote areas throughout the world often present to non-dental health practitioners with oral health problems.

While there is some previous investigation on the types and frequencies of oral health issue presentations to General Medical Practitioners, there are limited studies associated with pharmacists and oral health presentations. Consequently, this study provides evidence by interviewing rural and remote pharmacists as to their direct experiences of patients with oral health problems. This study also supports the recommendation of the Australian National Oral Health Plan 2015-2024 to encourage better interprofessional relationships and collaborations across all of the health professions, and to include oral health competency units in health care training programmes (Oral Health Monitoring Group, 2015). The literature described how non-dental primary care providers often lack substantive training and knowledge in the management of oral health issues, and this research project contributes to this literature as it explores the confidence levels of the identified non-dental primary care providers in the management of these conditions. Participants from this study describe their desire for better promotion of the benefits of good oral health and their lack of training for the management of oral health presentations. These findings corroborate with international literature which describe the interrelationships between oral and medical health.

Limited examples of interprofessional collaborations between dental and non-dental practitioners are reported in the international literature and this study adds to this body of knowledge by highlighting the infrequency of these communications in rural and remote Queensland communities. Very few relationship studies are reported in the literature between oral health care practitioners and medical practitioners, pharmacists or other allied non-dental health care providers. This study examines those unique relationships from the perspectives of both dental and non-dental care providers. The literature on the inter-relationships between medical and oral health is substantial. However the introduction of dental consultations into chronic care planning for medically compromised patients is still not mainstream in rural and remote telemedicine consultations and is an area that warrants further investigations.

Strategies to improve the provision of oral health care services to rural and remote communities from other parts of the world has been explored in the literature. This research adds to the body of literature by specifically examining three different models of oral health care delivery to eight outback Queensland which is an area of Australia that has not been examined. This area provides a substantial proportion of an important population group in Queensland. This research proposes recommendations for strategies to improve oral health care provision to this significant population group.

The introduction of intraoral cameras into medical practices has been reported in the international literature as an innovative way to improve access to oral health care for rural and remote communities. However the participants from this study are generally unfamiliar with the technologies. Many teledentistry studies have been published about intercommunications between different types of oral health care practitioners including dental practitioners, dental therapists, dental hygienists and dental specialists. There are however, very few studies that examine the possibility of situating intraoral cameras in emergency hospital departments, general medical practices or pharmacies to allow a non-dental health care provider, to directly access oral health care advice for their patient. This study contributes to original research as it examines the interest of rural and remote Queensland primary care providers in this different application for the technology. The introduction of better internet capabilities in rural and remote Queensland towards 2020 may mean that the possible utilisation for teledentistry may be recognised.

Findings from this research project suggest several recommendations that may be of interest to both dental and non-dental primary care providers to encourage better interprofessional collaborations. Consequently, the adoption of these suggested recommendations may result in better oral and medical outcomes for rural and remote residents. The recommendations may also be of further interest to organisation bodies because much broader benefits may result from the adoption of some of these suggestions. The dissemination of these findings may influence decisions for strategies to improve the provision of oral health services, not just to the people from the eight Queensland communities, but perhaps to all Australian rural and remote residents who have difficulty accessing timely oral health care.

6.6 An Ideal Oral Health Delivery Model for the Bush?

Is there such a thing as a perfect model of oral health care delivery in rural and remote Australian communities? A combination of strategies found in the three cases examined in this research project would possibly be closest to the most successful model. There is no single solution to the situations in relation to oral health care access in rural and remote regions because many variables exist that are different for each community.

An ideal scenario would be to have a continuously serviced, twenty-four hours a day centralised referral centre, where a highly trained dental receptionist might effectively triage dental appointments. The referring member of the non-dental primary care network would preferably be able to speak directly with the appropriate dental practitioner at any time, for timely advice about presenting dental issues.

A structured, standardised two-way written referral pathway across all the Queensland hospitals to both government and private dental practitioners would provide an effective interprofessional communication pathway, not just via an informal, unlogged telephone call. Regular face-to-face or teleconferenced meeting between dental practitioners and members of the non-dental primary care networks would break down siloed professional behaviours. These meetings would be for treatment planning sessions for patient care because oral health and medical health are not mutually exclusive.

Dental practitioners would have the ability to work in a mixed model of practice from existing government dental clinics allowing both Health Care Card and non-Health Care Card holders access to oral health care services. Private dental practitioners would be recompensed by the government for providing oral health care services to Health Care Card holding patients. This would make it economically viable to work in rural and remote locations as the private dental practitioner is reliant on a certain population base to have a workable practice. Dental practitioners would be provided with mobile dental units to travel to outreach centres to provide oral health services. Incentives to practice in rural and remote locations would be offered to dental practitioners and would include; appropriate remuneration, good accommodation, access to good schooling, travel allowances, and access to professional mentoring for new dental graduates. Dental students would experience a compulsory year of rural practice as part of their final year and they would receive excellent mentoring and educational opportunities via teledentistry.

Eligible patients who cannot afford to travel, or who do not own cars, or are too elderly to travel and rely on relatives for transport, would receive funding to travel to nearby dental practitioners. If these patients also have a health care card and cannot get a timely appointment with the government dental clinic, then they could access government funded dental vouchers to have oral health care provided by a private practitioner. Non-dental primary care providers would be upskilled to provide emergency dental care until the dentist was able to provide definitive treatment. This would further break down interprofessional barriers as the two professions would be co-operating to support the rural and remote patient.

Preventative care would become mandatory and a government funded campaign such as that for skin cancer, i.e. “Slip, slop, slap”, would begin to raise oral health awareness and to emphasise the interconnectivity between medical and oral health. Free toothbrushes would be distributed to all school aged children, as many families cannot afford toothbrushes. The importance of preventative oral health care would be introduced into school education programs and all non-dental primary health care providers would routinely include brief oral examinations and oral health preventative instruction in their mandatory check appointments. They would ideally be educated to recognise

dental issues and would refer these to a dental practitioner after explaining the importance of this appointment to the patient to maintain overall medical health.

The use of intraoral cameras established hospital communication networks, Skype networks, Smart Phones and telehealth webinars could facilitate more effective communication between dental practitioners and non-dental health care providers. A remotely located dental practitioner or dental specialist could participate in teleconsultation appointments, directly linked to medical practitioners, to triage dental patient appointments which could potentially save the rural and remote patient multiple trips to regional centres. Medical practitioners would be upskilled in basic emergency dental techniques and could access dental advice quickly via the use of intraoral camera technology and good internet capabilities to all rural regions.

In the ideal world, National and State inequities would be addressed and oral health care would be readily available to all Australians, regardless of location or socio-economic status.

6.7 Dissemination of findings

The knowledge and outcomes from this study have been disseminated through four peer reviewed journal articles and a final report for the larger project entitled “The relationship of dental practitioners to rural primary care networks”. The wider research project examined other Australian communities and included the data from this Queensland specific PhD thesis study. The larger project was a venture of the Australian Primary Health Care Research Institute (APHCRI), which is supported under the Australian Government’s Primary Health Care Research, Evaluation and Development Strategy. This paper has been completed as part of that research program by the Centre for Research Excellence in Primary Oral Health Care.

A presentation of this research was made to the Rural Health Workforce Australia (RWHA) Dental Research Exchange was made by the candidate in Melbourne 2015.

As a result of the findings for the need to upskill the non-dental primary care networks in dental emergency management techniques, the candidate has developed a series of presentations that she has been presenting, in a volunteer capacity, throughout Queensland and Tasmania from 2015 to 2018. The titles for these presentations are “The emergency management of dental presentations for medical practitioners” and “Oral presentations of medical issues”. These presentations are detailed at the beginning of this thesis.

6.8 Strengths and limitations of the research

This has been the first study to examine oral health services provided to the eight rural and remote communities examined in Queensland. A major strength of this study is in the methodological approach taken where the project developed into three descriptive case studies using thematic analysis. The use of multiple case studies allowed for data triangulation and the thematic analysis was cross referenced with the supervisors and the candidate checking the analysis for consistency. The study communities were selected by the Queensland Director of Oral Health Services which ensured accuracy in selection criteria. The strict recruitment protocols with initial phone contact followed by invitation letters, study information outlines and consent forms, ensured completely informed participation. The interview guidelines directed the interviews, and running notes in the fields, followed by verbatim transcription of interviews, ensured data authenticity.

A further strength of this study was the substantiation of the research findings by referencing regularly to the literature, which either supported or challenged the views of dental and non-dental health care providers from the communities studied, who had previously experienced oral health care management issues for their patients .

Although a reasonable number and range of different types of non-dental primary care provider participants (67) were interviewed, from eight small rural and remote towns from Central Queensland regions, only a relatively small number of dental personnel (12) were interviewed. The small number of dental personnel available for interview was directly due to the workforce shortages of dental personnel in the region. The high turnover of both dental and non-dental staff also meant that many of the health care practitioners interviewed may have worked in their communities for less than a year. The locum nature of the General Medical Practitioners interviewed (many staying for only one to three months) suggested that their lack of understanding of local community issues may have prejudiced their responses to some of the questions relating to relationships with visiting dental practitioners and their associated team members. This presented as a limiting factor for this research project. However the responses to the same questions from long term non-dental primary health care members were very similar to those who had not been in the communities for as long.

A further limiting factor was that even though 67 participants in total were interviewed, and it appeared that data saturation was achieved because no new data was emerging. It may be possible that not all the issues were discovered but all the eight communities examined reported common issues and strategies to address these issues. Different Queensland communities, outside of these eight that were examined, might have a different unique set of issues in relation to oral health care

access. Measurement biases as a result of the different types of interviews, telephone or face to face interviews, may have occurred. This limiting factor was addressed by using the same interview guide for all of the interviews.

This study essentially presented a "snapshot" of the situation at the time of the interviews. The length of time it has taken to write this thesis has meant that the situation as described in those interviews may have changed considerably over time.

Another limitation of this study was that Indigenous Health Care Workers were not specifically targeted and recruited to this study from the beginning. Four participants from one Indigenous Heath Centre in the second case study were incidentally interviewed in relation to their relationships with oral health care practitioners, and their comments enriched the data suggesting that further research into the unique cultural issues relating to oral health care provision in the Indigenous and Torres Strait Islander population would be a further topic of research requiring a much more detailed investigation than was within the scope of this study.

A further limitation of the study was that the patient perspective were not explored in relation to maintaining oral health and accessing oral health services in rural and remote areas. Additional strategies to alleviate the situation may have been uncovered by also collecting the views of patients as opposed to their providing health care professionals.

6.9 Future research

This study highlights a number of future directions for research are highlighted. Future studies can build on the existing information provided in this study by focusing on specific issues raised in the study. Opportunities for future research regarding oral health services for rural and remote communities have surfaced during this research project. It would be advantageous to conduct investigations on the 'patient journey' in relation to accessing oral health services in rural and remote regions. The direct effects on patients themselves from specific case studies would possibly provide additional strategies that may be different to those suggested by the health care professionals sampled in the current study.

At the time of interview there were oral health care workforce shortages and an imbalance in distribution, with more practitioners working in regional centres compared to the more remote regions. As discovered from the literature review, an oversupply of dental practitioners is projected to become apparent in Australia by 2020, due to more dental students graduating each year. It would be fascinating to revisit these same eight rural and remote Queensland communities in the future to discover if these newly graduated dental practitioners decided to embrace the lifestyle and

challenges of rural practice and locate to these communities? With this oversupply of dental graduates, it would be interesting to see if more mobile dental clinics will be established, or branch practices from central hub communities may be set up, or if fly-in fly-out dental practitioners begin visiting these regions more regularly from region centres, as more dentists seek employment?

Indigenous oral health care services were in a transition period during the time of interview in case study one, and there is now a dedicated Indigenous Service that is serviced by dental students on compulsory rural rotation. This community should be re-examined and findings compared with those from this research.

Another area for further research would be to implement and evaluate the recommendations proposed by this research project. The use of co-design with the communities would enable the community participants themselves to make an active contribution to the discussion and to engage in the formation of the solutions to the problems with oral health service delivery in their own communities. The participants have already suggested strategies to improve the situations researched. The next step would be to implement those changes with improved knowledge by considering the participants needs, giving immediate validation to the solutions. The long-term benefits of this type of design would be the higher degrees of satisfaction from the participants with increased levels of enthusiasm and support for changes to oral health delivery systems (Steen et al., 2011).

Teledentistry could be the way of the future but more study must be done to show the convenience, cost and time effectiveness in the utilisation of such a system for rural and remote patients. It would be fascinating to explore the possible applications for teledentistry in rural and remote Australia as the National Broadband becomes available and internet speeds become quicker and more stable towards 2020. As the National Broadband Network rolls out in rural and remote Queensland over the next few years and understanding for uses for teledentistry improves, it would be interesting to revisit these eight Queensland communities to see if they are more willing to embrace new technologies to improve interprofessional collaborations between the primary health care network and dental practitioners.

It would be of interest to evaluate the progress of one of the recommendations from this study for upskilling the members of the non-dental primary care networks. It would be of value to explore the benefits perceived by the 1000 or more General Medical Practitioners who have attended the upskilling lectures provided by the candidate from 2013-2018, to gauge their assessment for the benefits of this education program in their everyday practices. Pharmacists and other allied health

care providers have also attended education programs conducted by this candidate, and their value assessment would also contribute to further original research.

The impact on non-dental health care provider confidence in oral health emergency management and their changed appreciation for the importance of timely dental referrals to alleviate potentially preventable hospitalisations for medical conditions of dental origin, would constitute a further area for investigation.

6.10 Conclusion

This concluding chapter provides the final milestone for the candidate in the process of this PhD research project. It provides a summary of the research findings and provides answers to the four original research questions asked. Recommendations and suggestions are presented to address the specific barriers and challenges to good oral health for residents in the eight rural and remote communities in Queensland studied. The three different models of oral health care delivery examined from the rural and remote Queensland communities demonstrate aspects that were successful and some that are not as effective. This candidate concludes by hypothesising an "ideal" oral health care delivery model, which would benefit rural and remote dental patients, the primary care network health care providers and dental practitioners.

Within the bounds of the strengths and limitations of this study, this research may significantly contribute to the wider literature already available on the topic and the implications of these findings may be of possible interest to a broader group of researchers. The research findings might inform policy and practice recommendations on oral health care delivery in rural and remote Australia which in turn may direct further research into the future.

Finally, being a member of a skilled research team has been a wonderful experience for this new researcher. I have learnt many valuable research skills from my three experienced academic supervisors and this research journey has taken me on an amazing adventure. I have travelled to many outback communities during this doctoral study and have interviewed many "colourful" Australian characters. Conducting this research was not just about completing a thesis but was also an important personal journey. As a rural dental clinician, I have always concentrated on fixing just one patient at a time, but while participating in this project I have been able to explore the "bigger picture" outside of my four clinical walls and discovered the huge impact of poor oral health on a much wider population demographic from rural and remote Queensland.

The progression through this research journey has demonstrated the enormous gap in education that exists for the non-dental primary care network in regard to the management of emergency oral

health issues and has allowed myself, as an older experienced rural dental practitioner, to embark on a new and exciting career path into oral health education for non-dental health care providers. It is my greatest hope that this study may contribute valuable information about the poor state of rural and remote oral health care in Queensland to a wider audience and that this dissemination of knowledge may influence policy change, especially in light of the looming oversupply of new dental graduates who will be looking for jobs. Will they opt to practice in rural and remote Australia? As I look back on this long research journey with gratitude and satisfaction, I also look toward the future with great anticipation.

……. "It always seems impossible until it's done" Nelson Mandela…….

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Appendix A: Other Federal Government Funded Oral Health Schemes

Present schemes

The Pharmaceutical Benefits Scheme subsidises some medication for dental use. The Pharmaceutical Benefits Scheme (PBS) began as a restricted scheme in 1948, with free medicines for pensioners and a list of 139 'life-saving and disease preventing' medicines free of charge for others in the community. The PBS is part of the Australian Government's broader National Medicines Policy. Under the PBS, the government subsidises the cost of medicine for most medical conditions and a few dental conditions. Dentists are not able to prescribe general PBS items, but have a separate Dental Schedule from which they can prescribe dental care medicines for their patients (Australian Government Department of Health, 2014).

The Cleft Lip and Cleft Palate Scheme provides Medicare benefits for a range of dental treatments for adults and child with a cleft lip or cleft palate condition. An incomplete range of orthodontic work is offered and the surgical extraction of teeth if needed. Orthodontic treatment for children with a cleft palate or lip has been funded since 1981. Funding for general and prosthodontic services by a private practitioner can be obtained as well as financing of oral and maxillofacial surgery to be carried out by an oral or maxillofacial surgeon. The patient must be registered before the age of 22 to be eligible. An eligible patient will receive an identification card and can claim benefits until the age of 28. After age 28, patients can only claim for the repair of previous reconstructive surgery (Australian Government Department of Human Resources, 2014). Some specialist oral surgery and oral radiotherapy has been funded through Medicare since 1984 for the treatment of oral cavity and jaw disease (Biggs, 2008).

Past schemes

The Enhanced Primary Care Scheme (EPC) was introduced in 2004 and had Medicare pay for a limited number of dental procedures for patients with chronic diseases. This scheme was enhanced to become the Chronic Disease Dental Scheme (Dental Services New South Wales, 2012) and saw the first attempt at involving Medicare formally in general dental treatment. Medically compromised patients received a capped contribution for their dental care. This scheme was not a success due to budget blow outs and was abolished (Lam et al., 2012). The scheme was shut down in 2012 amid

controversy as the most expensive dental scheme in Australian history (Dental Services New South Wales, 2012).

The Medicare Teen Dental Plan was a means tested voucher system which entitled eligible teenagers to an annual dental check-up and was intended for children aged between 12 and 17 years. To be eligible for this service, their parents or guardians had to be entitled for Family tax benefits (Australian Government, 2013). It has been superseded by the Child Dental Benefit Schedule.

The Child Dental Benefit Schedule (CDBS) officially started in January 2014 (Biggs, 2012). The Child Dental Benefits Schedule was in its initial conception phase called Growing -Up Smiling (GUS). This program was for children between the ages of 2-17 years to allow access to basic government subsidized dental services. This was anticipated to originally affect 3.4 million children in Australia who were means tested. To be entitled for treatment the child had to be eligible to a Family Tax Benefit Part A or a relevant Government payment. Each child received $1000 over a two year period (Swan, 2013).

The Dental Relocation and Infrastructure Support Scheme (DRISS) was allocated $77.7 million over a 4 year period to allow approximately 300 dentists to relocate to rural and remote locations. The first round of dental funding occurred on 26th August 2013. Two types of grants were available. Relocation grants of $150 000-$250 000 and infrastructure grants of up to $250 000 were available for building new surgeries. Dentists going to very remote areas could apply for up to $350,000 (Swan, 2013). This scheme had benefits in Queensland for rural and remote residents where a dental practitioner does not already exist. (Health Workforce Queensland, 2016).

The Projects Flexible Grants Program gave $475 million to rural & regional infrastructure. This was to be used to repair and maintain existing rural dental clinics, build new public dental clinics in regional areas, and in particular the Royal Flying Doctor Service (Public Health Association of Australia., 2013). The 2014-2015 budget has ceased the funding for this program (Biggs, 2015).

The Voluntary Dental Graduate Year Program (VDGYP) was allocated $36 million in the 2012-2013 budget. The program aimed to make use of 50 new dental graduates coming from the dental schools each year. The new graduates who took up the program were expected to work in rural and remote area, aged facilities and Indigenous health services. The objectives of the VDGYP was to provide dental graduates with an organized program for improved practice experience and professional development opportunities, whilst increasing dental workforce and service delivery ability, especially in the public sector. Funding was provided for the development of the new program, dental graduate and pro-rata mentor salaries, incentive payments for dental graduates completing the

program and for additional infrastructure to support the VDGYP placements. They received a $15,000 bonus payment on completion of placement and Continuing Professional Development (CPD) which are needed to maintain dental registration (Dental Board of Australia, 2012). The Australian Council of Dental Schools established the curriculum.

Oral Health Therapists also established a similar type of program and $45 million was allocated to them for a graduate year program in the public sector. The University of Melbourne (through the Melbourne Dental School) was engaged by the Commonwealth of Australia to develop the Oral Health Therapist Graduate Year Program curriculum along with other members of the College of Oral Health Academics. This commenced in 2014 (Department of Health, 2013).

Funding for both the Voluntary Dental Graduate Year Program and the Voluntary Oral Health Therapist Program has ceased at the end of 2015, a full year earlier than scheduled (Department of Health, 2015).

The General Medical Practitioners Super Clinics Program established General Medical Practitioners clinics in 2007 which were designed to encourage better communication across the medical and dental professions. A General Medical Practitioners Super Clinic employed General Medical Practitioners, Practise Nurses, Allied Health Professionals (including Dentists) and Visiting Specialists. These clinics were designed to deliver health care to communities that had a multidisciplinary, co-operative approach to the provision of medical care which would allow more timely interventions and referrals for remote patients with dental issues. The Government committed $650 million to building more than 60 Super Clinics in Australia and to upgrading 425 existing buildings. The Super Clinics was to be supportive of their local community needs including the sensitivities of Indigenous and Torres Strait Islander peoples and older Australians in Residential Aged Care Facilities and community based settings (Department of Health, 2010). The funding for this scheme ended in 2015 (Australian Government, 2014).

A non-government organisation was awarded $6 million in the 2014-2015 budget to deliver emergency health care services to rural and remote communities in Australia (Australian Government, 2014). The NGO Mobile Dental Service which is a mobile dental clinic provided jointly by a private Queensland mining company and a non-government organisation directly benefitted from this funding (Q Coal Community Dental Service, 2014).

The Veteran's Affairs programs are funded by the government and provides dental treatment to veterans who have served in the Australian Defence Force. Amounts paid vary between White Card and Gold Card holders. The Gold Card is also issued to dependents and widows/widowers of

veterans and they are also entitled to these services. This scheme benefits 300,000 eligible people (Health Workforce Australia, 2013).

The Armed Forces and Army Reserve Dental Scheme supports regular Army or Reserve Army members who are on active duty and is covered by the Health Agency (DHA) a component of the Military Health System. Dental care is provided for service men and women and is funded by the Department of Defence (Biggs, 2008; Health Workforce Australia, 2013).

Work Cover is a Government body responsible for managing the workers compensation fund and overseeing work place occupational health and safety standards. Dental treatment is covered under the workers compensation board (Workers Compensation Regulatory Authority, 2009).

University training for dentists and dental therapists, dental hygienists and oral health therapists is funded by the government (Swan, 2013). The federal and state government has recognised the value of using dental students to supply treatment to Australians. The students are fully supervised by registered dentists. Clinics that are affiliated with universities included those at the University of Queensland, Griffith University, University of Newcastle, Charles Sturt University and James Cook University. Dental Hospitals in Melbourne, Adelaide, Westmead and Sydney utilise students to provide public dentistry at hospital clinics on student placement programs (Health Workforce Australia, 2013). When students train in universities as dentists in most states they gain their clinical experience by treating concession card holding patients in State-funded teaching clinics. As such they have extended funding towards dental education with the resourcing of four new oral health workforce programs: Dental Training Expanding Rural Placements (DTERP), University Departments of Rural Health (UDRH) Program, Voluntary Dental Graduate Year Program (VDGYP) and Oral Health Therapist Graduate Year Program (OHTGYP) (Australian Dental Association, 2013; Swan, 2013).

The Indian Ocean Territories Health Service (IOTHS) provides health services to the communities of Christmas and Coco's (Keeling) Islands. The Commonwealth of Australia, through the Christmas Island Administration, funds the IOTHS. Services provided included General Practitioner, Community Nursing, Community Health Programs, Emergency Service, Pathology Service and visiting Specialists and Allied Health Practitioners including dentists (Shire of Cocus Keeling Islands, 2014).

Asylum seekers health services were provided to individuals whilst detained (Keboa et al., 2016). They are offered medical and dental services that were funded by the government. The private sector also contributed to the treatment of patients through publicly funded schemes including the NSW Oral Health Fee for Service Scheme, SA General Dental Scheme, SA Emergency Dental Scheme, SA Pensioner Denture Scheme and WA Government Subsidised Oral Health Care Schemes (Health

Workforce Australia, 2013). The Tzu Chi Foundation was a group of volunteer dentists who treated refugees (Department of Health, 2012).

Pro -bono dentistry schemes including:

The National Dental Foundation was established by a group of independent dentists organised the direction of energies of dentists and dental companies in Australia wishing to donate time, equipment and materials to those in genuine need in the community. It was awarded $450 000 over 3 years in the budget for non-government not for profit organisations (Australian Dental Association, 2013; Department of Health, 2012).This foundation has the co-operation of community based organisations including; volunteer dentists, volunteer dental assistants, Australia dental industry association, Dental Hygienists' Association of Australia and the Australian Dental and Oral Health Therapists Association throughout Australia (Australian Dental Association, 2013; Department of Health, 2012).

Give a Smile (GAS) is a pro bono charity of the Australian Society of Orthodontists which offers free orthodontic treatment to specific special needs public patients over 2 years (Department of Health, 2012).

Indigenous oral health funding programs

Community Controlled Indigenous Medical and oral Health Services are commonwealth funded oral health services managed by the States and Territories (Williams et al., 2011). Culturally appropriate services are provided including oral health care to Indigenous persons residing in the area. Indigenous oral health schemes in Queensland include: Goondir Health Service, Brewarrina rural placement dental program, Crocodile smiles and Filling the Gap (Health Workforce Australia, 2013; Williams et al., 2011).

Goondir Health Services are dental facilities affiliated with the University of Queensland Dental School and Goondir Health Services. They are situated in Dalby, Oakley and St George in Queensland but also services the greater Western Downs region. Final year dental students provide the dental care under the direct supervision of a qualified dentist. All dental students have a final year placement component of their studies. Goondir provides a placement option for these students. Goondir is funded by the Department of Health, Office for Indigenous and Torres Strait Islander Health. The University of Queensland is funded by The Commonwealth Department of Health for the "Dental Training - Expanding Rural Placements" (DTERP) program (Edith Cowan University, 2013).

Brewarrina rural placement dental program utilises Queensland dental students in fifth year from Griffith University for placement in Brewarrina which is an Indigenous remote community in NSW (Williams et al., 2011).

Crocodile smiles is an educational and support orientated program designed for Indigenous children in Cape York and Cairns Health Service Districts. Its aim is to supply resources for Indigenous Health Care Workers to help teach children and families about the importance of oral health (Williams et al., 2011).

Filling the Gap is a community outreach program and was established in 2009 by the University of Adelaide's School of Dentistry. It is based in far North Queensland. There is a Community Controlled Indigenous Health Service in the area called Wuchopperen. Volunteer dentists are recruited by "Filling the Gap" to work here which is a program designed to offer clinical treatment and education to disadvantaged people in Adelaide (Jackson et al., 2009). The program has expanded and recruited 180 dentists over the years to work in Indigenous controlled health services. Wuchopperen provides accommodation and funds for the airfares to Cairns. This program works in partnership with Muru Marri Indigenous Health Unit and Nura Gili Indigenous Programs at the University of New South Wales (Jackson et al., 2009). The program covers the cost of airfares and travel including accommodation. Dentists volunteer for between one and two weeks at a time. In addition, volunteer dental hygienists, therapists and dental nurses also provide this support (Australian Government Department of Health, 2013b).

Appendix B: Oral Health Funding Arrangements in other Countries

There were generally considered to be four primary methods of funding health systems in the world today.

I. General taxation of the states, which occurs in Cyprus, Ireland and Spain.
II. Universal funding supports the taxation of the whole population however, treatment options and availability are variable. Countries that support this scheme include the UK, Italy and Denmark.
III. Income ceiling funding occurs in Germany where income-based criteria restricts access to dental care.
IV. No income ceiling where other criteria determine access to subsidised care, which occurs in Austria, France, Lithuania, Poland and Romania (Kravitz & Treasure, 2009).

The most recent changes in European oral healthcare were in Eastern Europe, where there had previously been public dental services that had been privatised. The Eastern European states are now developing insurance systems to cover oral health care costs. In Southern Europe treatment of children and special needs groups have been increasingly funded by the governments to public dental services.

Another model of oral health care called the Bismarkian Model, offers health insurance for a wide population coverage with comprehensive treatments and the added benefits of repeat appointments. This oral health care delivery model is reported to be utilised in many other non-European Union countries but was experiencing financial difficulties at the last documented analysis (Widstrom & Eaton, 2004).

Iran had four major social dental health insurance funds which are mainly funded via the Bismarkian system where the whole population including the employee, the employer, and the government contribute to resourcing the program. Approximately 90% of Iranians are covered by this health insurance system but the complex revenue-collection schemes and unconnected insurance groups mean that this complicated scheme often results in many Iranian individuals paying their dentist directly for dental services (Jadidfard et al., 2012). Table 2.1 below presents a summary of the funding arrangements for European countries (Biggs, 2012).

Funding arrangements for European Countries.

Country	Funding Arrangement
Austria	99% of the population had compulsory health insurance paid for by themselves with a small amount paid by employers.
Denmark	The schools provided free health care including orthodontics up to the age of 18. No free dental care for adults and 30% of adults had private health insurance. The state payed for dental costs for some disadvantaged groups.
Finland	Dental care was shared between private payers, the government and social insurance. Half the population had private health insurance.
Germany	87.5% were members of a not for profit Sick Fund which gave a free basic dental care package. Those self-employed or with high incomes couldn't join the "Sick Fund" and had private health insurance. High end dentistry was paid for privately.
Greece	Dentistry was free at National Health Service to everyone but was preventative and targeted to children. Very few had private dental insurance and one third of the population paid for dentistry.
Italy	They had a National Health Service that supplied extractions but not restorations. Only emergency treatment was supplied. Private health insurance often didn't cover dentistry, so patients paid for their treatment.
Mexico	A universal scheme of social security covered more than half of the population's dental needs. Another 20% were covered by a voluntary health program that was publicly funded
Poland	Narodowy Fundusz Zdrowia (NFZ) was a health insurance fund that had financed the health care system since 2003. Everyone paid 9% of their wages and received free medical and limited dental. Private dentists worked for NFZ and the hospital also. Two-thirds of dentists worked privately, and patients could go there also.
Spain	Some funding went to hospital dental clinics for basic work only. Mostly private dentists exist that patients must pay.
Sweden	A National Social Insurance Scheme funded dentistry as well as health care. Free care was provided through public dental clinics for children up to 19. In 2008 a voucher system was introduced allowing a set amount per year to put towards dental needs.
Turkey	One third of the population were uninsured and the others had government subsidizing.
United Kingdom	National Health Service funded via taxation since 1948 and provided treatment free for children up to 19. Free dentistry was available at hospital clinics for emergency treatment and specific groups. Dentists could work privately under the General Dental Service and patients made co-payments outside the NHS amount.

Source (Biggs, 2012)

The American system of funding for oral care is like that found in Australia. Private practice delivers most of the oral care in America. The dental profession provides dental care privately and are paid either directly or by an insurance provider. A funding mechanism utilised by many Americans is a "Health Savings Account". These types of health savings accounts pay for medical and dental expenses with funds deposited into these accounts either personally or by the employer before it is taxed. These funds are only allowed to be used for dental and other medical expenses . Two thirds of the American population receive privately funded dental care, but the other third is generally disadvantaged socioeconomically, or live in rural and remote locations. America provides a 'Safety Net System' for this section of the population. This involves dental care being provided by private practitioners participating in government-funded schemes such as; Medicaid which is a jointly federal and state program that helps with medical costs for some people with limited income and resources, Veteran's arrangements, federally funded health Centres, the Indian Health Service, dental and oral hygiene school clinics and some other schemes (Mertz & Finocchio, 2010).

Appendix C: Managing and analysing qualitative data using NVivo10 software.

Qualitative research evaluates and interprets social situations and events. Unstructured or semi-structured data including: interviews, focus groups, surveys, field notes, audio, social media, web pages and journal articles are often used in this type of research. Quantitative methodologies often utilise computer assisted software for data analysis and likewise qualitative data can also be analysed with specialised software packages. The quantitative analysis software SPSS (Statistical Package for the Social Sciences) have been used by researchers for a long time (Jones, 2007). Manuel coding of data is still an accepted and widely used method of data collating and analysis and the choice to use either computer assisted, or manual analysis has been shown to be dependent on the size of the project (the physical amount of data to be processed through), the funds and time available (Basit, 2003). Computer assisted analysis can shorten investigation timeframes and provide more thorough and accurate coding and interpretation (Jones, 2007).

NVivo10 is a computer program that helps organise, manage and find patterns in entered data. The use of computer assisted software packages such as NVivo10 is a valuable aid in reducing the complexity of organising this type of research, but it cannot replace the researcher's analytical skills (Bazeley & Jackson, 2013). Once the data has been suitably organised it is then the researcher's role to immerse themselves in the data and make sense of the true picture being presented.
The development of software programs to aid in analysis has a significant effect on how research is done. In our technological world where data sources are significantly changing, consider social media and the web and videos as data sources, then the days of hand collating data might well be leaving us. Before the days of computer coding analysis researchers placed more emphasis on reading and re-reading the text, reflecting on issues and writing notes and memos to draw connections between the data. (Bazeley & Jackson, 2013). The software programs used today such as NVivo10 have understood this essential element of qualitative research. Grounded theory is an methodology where the researchers perform data collection and analysis, memo writing, coding, and model creating, all interchangeably (Bringer et al., 2006). NVivo 10 has improved their memo making software, modelling tools and linking capacities and so enable researches to analyse data instead of just churning out a series of themes without thought. The flexible design of NVIVO, enables such versatility. Many researchers using software unfortunately continue to only provide an

account of the research or a quantitative content analysis rather than an descriptive model (Bringer et al., 2006). The effectiveness of computer assisted software as a useful research tool can depend greatly on the ease of operation of the program and the computer skills of the researcher. The reliability of the data can be directly proportional to skill levels of the operator, so it is essential that researchers are well trained in the use of the program they choose to operate. The skilful use of software to aid analysis has been shown to enhance validity of a qualitative research project (Kikooma, 2010).

NVivo10 allows data entry from many different sources including documents, PDFs, audio s or transcribed interviews, videos, pictures and memos written along the way in the program. The process of gathering material by topic, idea or theme is called coding. Nodes are the headings that each concept is stored under. At first related material is gathered in one place so that emerging patterns and ideas can be identified. These are called parent nodes and under these the child nodes develop which consist of sub-themes under the main headings. Each child node similarly can have groups of concepts which can give a tertiary level of coding called grandchild nodes. In this way the data can be easily grouped and accessed. Node classifications allow data to be sorted into nodes about people or places (demographic data) and source classifications keep track of sources such as bibliographical data which could be useful for literature reviews (QSR International Pty Ltd, 2014). Once all the data is coded then analytics can be applied to the data set. This is when Queries can be performed that cross-tabulate and link the pieces of data to form the picture we are investigating. At this point the researcher uses their skills as thinking analysers to manipulate the queries to ask the questions need to be asked. The computer assisted software stores and organises the data, but the researcher directs the enquiries. Words or phrases in your sources and nodes can be analysed and patterns and questions can be explored as they emerge. Performing a coding query gathers all the coding at any combination of nodes. Matrix coding queries are the ones I like to use most as it allows specific cross tabulation or 2 search criteria e.g. “How many presentations of emergency dental problems presented to pharmacists? “With computer assisted software it is possible to check for coding consistency among team members and so validate the research more readily. This is done using a coding comparison query which compares the coding of two researchers or two groups of researchers(QSR International Pty Ltd, 2014). These attributes of NVivo 10 provide an excellent opportunity to employ assisted computer software analysis as it gives enhanced validity to qualitative research and encourages a more collegial response from those that focus purely on quantitative research.

Figure AC.1: Nvivo 10 representation, Case Study 1

Figure AC.2: Nvivo 10 representation Case Study 2

Appendix D: Ethics Approval and Amended Approval Documentation

Office of Research Services
University of Tasmania
Private Bag 1
Hobart Tasmania 7001
Telephone + 61 3 6226 7479
Facsimile + 61 3 6226 7148
Email Human.Ethics@utas.edu.au
www.research.utas.edu.au/human_ethics/

HUMAN RESEARCH ETHICS COMMITTEE (TASMANIA) NETWORK

UTAS

13 May 2013

AssocProf Tony Barnett
C/- Rural Health

Sent via email

Dear AssocProf Barnett

REF NO: H0013217
TITLE: Relationship of dental practitioners to rural primary care networks

PROTOCOL dated 29 April 2013
Application Form Low Risk
Information Sheet for GP participants
Information for interview participants
Interview Guide
Invitation letter to chief dentists
Invitation letter to GPS
Invitation Letter to organisation
Invitation to primary care providers
Information Sheet primary care providers

The Tasmania Health and Medical Human Research Ethics Committee considered and approved the above documentation on **13 May 2013** to be conducted at the following site(s):

This approval constitutes ethical clearance by the Health and Medical HREC. The decision and authority to commence the associated research may be dependent on factors beyond the remit of the ethics review process. For example, your research may need ethics clearance from other organisations or review by your research governance coordinator or Head of Department. It is your responsibility to find out if the approval of other bodies or authorities are required. It is recommended that the proposed research should not commence until you have satisfied these requirements.

All committees operating under the Human Research Ethics Committee (Tasmania) Network are registered and required to comply with the *National Statement on the Ethical Conduct in Human Research* (NHMRC 2007 updated 2009).

Therefore, the Chief Investigator's responsibility is to ensure that:

(1) The individual researcher's protocol complies with the HREC approved protocol.

(2) Modifications to the protocol do not proceed until **approval** is obtained in writing from the HREC.

(3) Section 5.5.3 of the National Statement states:

Researchers have a significant responsibility in monitoring approved research as they are in the best position to observe any adverse events or unexpected outcomes. They should report such events or outcomes promptly to the relevant institution/s and ethical review body/ies and take prompt steps to deal with any unexpected risks.

The appropriate forms for reporting such events in relation to clinical and non-clinical trials and innovations can be located at the website below. All adverse events must be reported regardless of whether or not the event, in your opinion, is a direct effect of the therapeutic goods being tested.
http://www.research.utas.edu.au/human_ethics/medical_forms.htm

(4) All research participants must be provided with the current Patient Information Sheet and Consent Form, unless otherwise approved by the Committee.

(5) The Committee is notified if any investigators are added to, or cease involvement with, the project.

(6) This study has approval for 4 years contingent upon annual review. A *Progress Report* is to be provided on the anniversary date of your approval. Your first report is due 13 May 2014. You will be sent a courtesy reminder closer to this due date.

(7) A *Final Report* and a copy of the published material, either in full or abstract, must be provided at the end of the project.

Should you have any queries please do not hesitate to contact me on (03) 6226 2764.

Yours sincerely

Lauren Black
Ethics Administrator
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Tel: +61 (03) 6226 2764
Email: lauren.black@utas.edu.au
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HUMAN RESEARCH ETHICS COMMITTEE (TASMANIA) NETWORK

UTAS

09 July 2013

AssocProf AP Barnett
Rural Health

Sent via email

Dear AssocProf Barnett

REF NO: **H0013217**
TITLE: **Relationship of dental practitioners to rural primary care networks**

- *invitation letter to GPs*
- *invitation letter to organisation*
- *interview guide*

The Tasmanian Health and Medical Human Research Ethics Committee considered and approved the above amendment documentation on 03 July 2013.

All committees operating under the Human Research Ethics Committee (Tasmania) Network are registered and required to comply with the *National Statement on Ethical Conduct in Human Research* (NHMRC 2007).

Should you have any queries please do not hesitate to contact me on (03) 6226 2764.

Yours sincerely

Heather Vail
Ethics Administrator
Office of Research Services
Email: Heather.vail@utas.edu.au
University of Tasmania
Private Bag 01 Hobart Tas 7001

Appendix E: Invitation letter to Participants

Locked Bag 1372, Launceston
Tasmania 7250 Australia
Telephone (03) 6324 4000
Facsimile (03) 6324 4040
Email rural.health@utas.edu.au
Web www.utas.edu.au/ruralhealth

UNIVERSITY DEPARTMENT OF RURAL HEALTH

Dear [Dentist, General Medical Practitioner, Pharmacists, Practice manager, Other Health Care Providers],

"Relationship of dental practitioners to the primary care network in rural and remote Queensland and the application of technology in the management of dental problems"

My name is Dr Jackie Stuart. I am a dentist from Mackay with 28 years of experience as a clinical dentist. I am presently doing my PhD and am also an investigator with the Centre of Research Excellence (CRE) in Primary Oral Health Care and would like to invite you and your team to participate in the above research project. We are working with the Australian Primary Health Care Research Institute (APHCRI). The APHCRI is funded by the Commonwealth Department of Health. This project aims to describe strategies that can be used by non-dental primary health care practitioners to improve the provision of oral health services to rural and remote communities.

I would appreciate your assistance as a participant in this study because you have been involved in treating patients with oral health problems in rural and remote Queensland. We are interested in any ideas you may have that could help the non-dental primary health care network to communicate their patient's oral health care needs to you when you are not in that community.

We have already interviewed doctors, community and child care nurse, mental health nurses, speech pathologists, pharmacists and dental health care providers in the second Queensland region communities of Winton, Alpha and Blackall and also in the Central Queensland communities of Cunnamulla, Quilpie, St George and Mitchell.

We would like to invite you and your team to participate in a 30-40 minute interview. I can travel out to you or do phone interviews.

Attached is an information sheet that describes the nature of the research for your information.

I look forward to your participation in this research project.

Yours sincerely

Jackie

Dr Jackie Stuart BDSc /Adjunct Lecturer
Centre of Research Excellence in Primary Oral Health
Centre for Rural Health (CRH)
School of Health Sciences| University of Tasmania
Phone: 04.....
Email: Jacqueline.stuart@utas.edu.au

Appendix F: Information Sheet

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Telephone (03) 6324 4000
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Web www.utas.edu.au/ruralhealth

UNIVERSITY DEPARTMENT OF RURAL HEALTH

Information Sheet for Dental and Non- Dental Primary Care providers

You are invited to participate in a research study entitled "Relationship of Dental Practitioners to the Primary Care Networks in Rural and Remote Queensland and the Application of Technology in the Management of Dental Problems."

This project is being conducted by Dr Jackie Stuart, A/Prof Tony Barnett, Dr Ha Hoang and Dr Leonard Crocombe from the Centre of Research Excellence (CRE) in Primary Oral Health Care at the University Department of Rural Health, University of Tasmania.

1. **Purpose of this study**
   The study aims to describe strategies that can be used by primary care practitioners to improve the provision of oral health services to rural and remote communities.

2. **Why have you been invited to participate?**
   You have been invited to participate in this study because you are a community primary health care provider who may have been involved in treating or providing advice to a patient with an oral health problem.

3. **What does this study involve?**
   - You will be contacted by email or telephone to arrange an appropriate time and date to undertake a 20-30 minute interview.
   - You will be provided with an outline of the questions prior to the interview.
   - At the start of the interview we will seek your permission to audio-record the interview, you may decline permission.
   - You will be asked questions relating to your experiences and views of providing oral health care for your community and strategies which could improve the oral health services to meet the needs of the local community.

- You are able to withdraw from the study and withdraw your data at any time within seven [7] days of the interview.

All interview data used in this study will be kept in a locked and secure filing cabinet and password protected computers in the University of Tasmania, Department of Rural Health and will be destroyed five [5] years after the completion of the study.

4. Benefit of the study

We believe that you could provide valuable insights into strategies that may be used to improve oral health care in your community. Your participation in this study will contribute towards the development of:

- guidelines to assist in the establishment of effective networks between oral health professionals, community pharmacists and hospital networks to encourage appropriate and timely referrals to dentists and other oral health practitioners;
- pathways and care plans for oral health problems that are responsive to local needs and cognisant of available resources; and
- policy recommendations to improve the provision of dental care and other oral health service to rural communities.

5. Possible risks from participation in this study?

The only foreseeable risk involved in participating in this study is inconvenience. You might have to give up your time to participate in the interview. However, your participation is important to us.

6. Anonymity and Confidentiality

Participation in this study is voluntary and any research data gathered during this study will be kept confidential. Your identity will be kept confidential and any information you supply will not identify you as a participant.

7. How will the results of the study be published?

The research will be published in a report and in peer-reviewed journals. Copies will be available through the University of Tasmania, Department of Rural Health. Participants will be notified, if they request it, of completed findings and publications via email, or in writing, and will be provided with details on how to access findings or publications electronically e.g. Internet web URL. Hardcopies will be provided on request by participants.

8. What if I have questions about this study?

If you would like to discuss any aspect of this study, please feel free to contact our research team members.

- A/Prof. Tony Barnett Tony.Barnett@utas.edu.au (03) 6324 4011
- Dr Ha Hoang Thi.Hoang@utas.edu.au (03) 6324 4031
- Dr Len Crocombe Leonard.Crocombe@utas.edu.au (03) 6226 7798
- Dr Jackie Stuart Jacqueline.Stuart@utas.edu.au 04.....

This study has been approved by the Tasmanian Health and Medical Human Research Ethics Committee (HREC). If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on (03) 6226 7479 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number [H0013217].

Thank you for taking the time to read this information sheet. The sheet is yours to keep.

Appendix G: Interview Guide

Relationship of Dental Practitioners to the Primary Care Networks in Rural and Remote Queensland and the Application of Technology in the Management of Dental Problems.

PART 1: PROFILE OF THE ORGANISATION

GP Practice	Hospital (or equivalent)	Pharmacy	Dental practice
• Type of practice (group practice, solo practice) • Numbers and type of staff • Opening hours. • On-call and after hour service provision?	• Number and type of staff • Number of beds • Opening hours • Services provided. • Emergency services (ED)?	• Number and type of staff • Type of business - Independent - Multiple owned • Opening hours. • What are oral healthcare products available in your pharmacy? ☐ Toothpastes/gels ☐ Toothbrushes ☐ Electric brushes ☐ Mouthwashes ☐ Floss ☐ Other id cleaners ☐ Tooth-whitening systems ☐ Children's toothpastes ☐ Children's toothbrushes ☐ Children's electric brushes ☐ Dental gum/breath fresheners ☐ Denture care products	• Type of practice (group practice, solo practice) • Numbers and type of staff • Opening hours. • On-call and after hour service provision?

		☐ Disclosing tablets ☐ Tongue scrapers ☐ Dental mirror ☐ Other	

PART 2: BACKGROUND OF THE PARTICIPANT

- Sex: male or female
- Age group
- Profession
- Years since graduation
- Years in current practice
- Any areas of specialisation

PART 3: OPENING QUESTIONS

As you know, in areas where there is a shortage of oral health practitioners, people can turn to your practice for advice. We are interested in finding strategies that can be used by primary care practitioners to improve the provision of oral health services to rural and remote communities.

Could you tell me a little about your experiences with this?

GP Practice	**Hospital (or equivalent)**	**Pharmacy**
Q1. Can you estimate how many people present to your practice with oral health problems per month? What proportion of your clients does this represent?		Q1.Can you estimate how many people request advise about their oral health or oral health product advice each month? What proportion of your clients does this represent?
Q2. What oral health advice/treatment are these people requesting? (e.g. ulcers, toothache/pain relief, broken/lost fillings, trauma, oral infections, teething,		Q2. What oral health advice are these people requesting?

sore mouth, mouthwash, dentures, bleeding gums etc.)	(ulcers, toothache/pain relief, broken/lost fillings, trauma, oral infections, teething, sore mouth, mouthwash, dentures, bleeding gums, toothpaste advice, toothbrush, tooth whitening etc.)
Q3. How do you respond? What actions/s do you take? ☐ Suggest client sees a dentist ☐ Suggest client sees other dental practitioners ☐ Give oral hygiene advice ☐ Provide prescriptions for antibiotics ☐ Provide short-term pain relief ☐ Other	Q3. What do you recommend people to do for an oral health problem? ☐ See a dentist ☐ See other dental practitioners ☐ See a doctor ☐ Give oral hygiene advice ☐ Provide non-prescription antibacterial medicine ☐ Provide short-term pain relief ☐ Other
	Q3a. Which factors would influence your recommendations of oral healthcare products? ☐ Advertising ☐ Comprehensive knowledge of product ☐ Personal Experience

		☐ Popularity of product ☐ Only gave general advice ☐ Oral Health Training ☐ Other
Q4. How confident are you in providing oral health care advice? ☐ Very confident ☐ Confident ☐ Sometimes not confident enough ☐ Not confident ☐ Not at all confident		
Q5. In your opinion, what strategies and interventions should be taken to improve oral health services to better meet the needs of your local community? (Can you describe the basis for your opinion about this e.g. your training or experience elsewhere, the research evidence for what works, your direct observations of issues in this community etc.?)		

PART 4: ORAL HEALTH NETWORKING QUESTIONS

Over the last 12 months….

Q6. To whom you regularly talk when you need to solve an oral health problem for your patient/client? (Within and/or outside your practice)

Q6a. Do you speak to any member of the primary care network to offer advice on triaging dental problems in their community when you are not in residence? (Dental practitioners)

Q6b. How often does a member of the primary care network contact you for advice about a patient with a dental problem? How do they contact you? (Dental practitioners)

Q7. How often do you talk to the individuals identified in the above question?

- Often (indicating that two contacts speak often with one another and are familiar with one another e.g. once every 2 weeks).
- Sometimes (indicating that two contacts speak with each other from time to time and know something about one another, but are not especially close e.g. once every 2 months)
- Rarely (indicating that two contacts s speak infrequently and are unfamiliar with each other e.g. once each year)
- With difficulty (indicating that contacts have difficulty coordinating between the two contacts for one reason or another).

PART 5: RELATIONSHIP WITH DENTAL PRACTITIONERS (primary care providers)

Q8. Could you tell me where the nearest dental surgery is?

Q9. How often do you contact the dental surgery for advice or refer a patient to that surgery? How do you contact them?

Q10. What are their availability and their opening times?

Q11. How do you arrange for an appointment with a dentist/dental practitioner case of emergency?

Q12. Can you describe how, if at all, you work with the relevant dentist/dental practitioner to manage a patient with ongoing chronic dental and other related health complications?

PART 6: TECHNOLOGY QUESTIONS (Dental practitioners)

Q13. In your opinion would the use of intra oral cameras by medical practitioners to send diagnostic pictures to you be of benefit in aiding communication of dental emergencies?

Q14. Would the use of teleconferencing be of benefit for distance diagnosis of dental problems?

PART 7: CLOSING QUESTIONS

Q15. Would you be interested in further developing your oral health knowledge through courses or oral health programmes? What kinds of training would up skill you for the particular needs you face in your community?

Q16. Would you be interested in participating in oral health promotional activities in your community? (Why would you and would not you be interested?) What kinds of oral health promotional activities would meet the particular needs you see in your community?

Q17. Do you have any other comments or suggestions about oral health services for people in your community?

Thank you so much for talking with me/us. Do you have any questions you would like to ask?

If you would like a summary or copy of the results from this study, please let me know the best way to contact you (e-mail/phone/post).

Appendix H: Participants' attributes

Participant	Communities	Age	Gender	Years since gradu-ation	Years in current practice	Opening hours	Type of practice	After hours care	Number and type of staff
Private Dental Practitioner 1	Hub Community Case Study 1	40-50	Female	20	5 years	9.00-5.00 Mon -Fri	Private & Government	Yes	2 dentists and 2 dental nurses
Private Dental Practitioner 2	Case study 1 Town D	60	Male	35	6 months	9.00-5.00 Mon -Fri	Private & Government	No	1 dentist
Private Dental Practitioner 3	Hub Case Study 1	67	Male	35	Locum for 2 months a year for 4 years	9.00-5.00 Mon -Fri	Private Practice	No	2 dentists and 3 dental nurses
Dental Assistant 1	Case Study 1 Town D	40	Female	20	15 years	9.00-4.00 Mon to Friday	Government dental clinic	N/A	1 nurse, 1 therapist and 1 dentist and 1 dental assistant?
Government Dental Practitioner 4	Hub Case Study 2 Case Study 3	23	Male	1	1 year	9.00-5.00 Mon -Fri	Government	Yes	1 dentist and 1 dental assistant
Private Dental Practitioner 5	Case Study 2 Town F	60	Male	35	3 years comes monthly for 3-4 days	9.00-5.00 Tues – Thurs once a month	Private Practice	No	1 dentist and 1 dental nurse
Private Dental Practitioner 6	Hub Case Study 2 Case Study 3	41	Male	20	20years	9.00-5.00 Mon -Fri	Private Practice	No	1 dentist and 1 dental nurse
Dental Therapist	Hub Case Study 2 Case Study 3	30-40	Female	20	20 years	9.00-5.00 Mon -Fri	Government School Dental	No	1 therapist and 1 dental nurse

Dental Practitioner 7	Case Study 3	40-50	Male	25	1.5 years	8.00-6.00 Mon -Sat 2 weeks on and 1 week off	NGO	No	2 dentists and 4 dental nurses
Dental Practitioner 8	Case Study 3	50-60	Male	25	3 months	8.00-6.00 Mon-Sat 2 weeks on and 1 week off	NGO	No	2 dentists and 4 dental nurses
Dental Practice Manager	Case Study 3	20-25	Female	10	2.5 years	9.00-4.00 Mon -Fri	NGO	N/A	1 practice manager
Dental Assistant 2	Case Study 3	50-60	Female	35	2.5 years	8.00-6.00 Mon-Sat 2 weeks on and 1 week off	NGO	No	2 dentists and 4 dental nurses
General Medical Practitioner 1	Case Study 1 Town D	30-40	Male	15	4 years	24/7	Government Hospital	Hospital	5 doctors, medical auxiliaries
General Medical Practitioner 2	Case Study 1 Town D	20-30	Male	6	6 years	24/7	Hospital	Yes	5 doctors, medical auxiliaries
General Medical Practitioner 3	Case Study 1 Town D	30-40	Male	10	3 years	24/7	Government	Yes	5 doctors, medical auxiliaries
General Medical Practitioner 4	Case Study 1 Town D	20-30	Male	5	2 years	24/7	Government Hospital	Yes	5 doctors, medical auxiliaries
General Medical Practitioner 5	Case Study 1 Town D	30-40	Male	4	1 year	24/7	Hospital	Yes	5 doctors, medical auxiliaries
General Medical Practitioner 6	Case Study 1 Town D	20-25	Female	Student	2 months	24/7	Hospital	24/7	5 doctors, auxiliaries
General Medical Practitioner 7	Case Study 1 Town D	20-25	Female	Student	2 weeks	24/7	Hospital	Yes	5 doctors, medical auxiliaries
General Medical	Case Study 1 Town D	22	Female	student	6 weeks	24/7	Hospital	Yes	5 doctors, medical auxiliaries

Practitioner 8									
General Medical Practitioner)	Case Study 1 Town D	50-60	Female	30	20 years	9.00-5.00 Mon-Fri Sat 9.00-12.00	Private Practice	Yes	doctor and receptionist
General Medical Practitioner 10	Case Study 1 Town D	30-40	Male	10	9 months	9.00-5.00	Government Hospital	Indigenous Governmt Clinic	1 doctor 2 nurses
General Medical Practitioner 11	Case Study 1 Town A	30-40	Male	10	5 years	9.00-5.00 Mon-Fri	Private/ Government	Yes	2 doctors ,3 nurses, practice manager, DON
General Medical Practitioner 12	Case Study 1 Town A	50-60	Female	35	2 weeks	9.00-5.00 Mon-Fri	Private/ Government	Yes	2 doctors ,3 nurses, practice manager, DON
(General Medical Practitioner 13	Case Study 1 Town C	40-50	Male	10	10 days	2.00-5.00pm 5 days a week	Private/ Government	linked to hospital	receptionist and 2 locums GP
General Medical Practitioner 14	Case Study 1 Town B	60-70	Male	40	4 weeks	9.00-5.00 Mon-Fri	Private and Government	Yes	2 doctors and 2 staff
(General Medical Practitioner 15	Case Study 1 Town B	40-50	Male	20	6 weeks	9.00-5.00 Mon-Fri	Private and Government	Yes	2 doctors and 2 staff
General Medical Practitioner 16	Case Study 2 Town G	30-40	Male	15	4 years	9.00-4.30 Tue-Thu	Government Hospital and Private Practice	Hospital	1doctor, Receptionist, DON and 3 nurses
General Medical Practitioner	Case Study 2 Town F	40-50	Male	20	6 years	8.30-5.00 Mon-Fri 8.30-12.00 Sat	Private/ Hospital	2 weeks on and 2 weeks off	2 GPs, Practice Manager receptionist, 2

17									nurses, locum GP
General Medical Practitioner 18	Case Study 2 Town F	50-60	Male	30-4	3 years	8.30-5.00 Mon-Fri 8.30-12.00 Sat	Private/ Hospital	2 weeks on and 2 weeks off	2 GP, Practice Manager receptionist2 GP
General Medical Practitioner 19	Hub community Case Study 2 Case Study 3	60-70	Male	40	20 years	9.00-5.00 Mon-Fri	Executive director of Medical Services	24/7	Large Hospital and outreach centres
Medical Practice Manager 1	Case Study 1 Town B	40-50	Female	N/A	2 years	8.30-5.00 Mon -Fri 8.30-12.00 Sat	Private Practice	No hospital does it	2 receptionist and 2 doctors
Medical Practice Manager 2	Case Study 1 Town A	30-40	Female	N/A	5 years	8.30-5.00 Mon -Fri 8.30-12.00 Sat	Private Practice	No hospital does it	1 receptionist 2 doctors
Medical Practice Manager 3	Case Study 1 Town D	30-40	Female	N/A	10 years	9.00-5.00 Mon -Fri	Indigenous Services	No	1 receptionist 1 doctor
Medical Practice Manager 4	Case Study 1 Town D	30-40	Female	N/A	10 years	8.30-5.00 Mon -Fri 8.30-12.00 Sat	Private Practice	No	2 receptionist and 2 doctors
(Medical Practice Manager 5	Case Study 2 Town E	50	Female	N/A	11 years	9.00-5.00 Mon-Fri	Private GP Practice	24/7	1 permanent GP
Medical Practice Manager 6	Case Study 2 Town F	40	Male	25 years	4 months	8.30-5.00 Mon-Fri 8.30-12.00 Sat	Private GP Practice	No	3 GP's practice manager, receptionist and 2 RN's
Medical Receptionist 1	Case Study 1 Town D	30-40	Female	N/A	2 years	8.30-5.00 Mon -Fri 8.30-12.00 Sat	Private Practice	No	2 receptionist and 2 doctors
Medical Receptionist 2	Case Study 1 Town B	30-40	Female	N/A	5 years	8.30-5.00 Mon -Fri 8.30-12.00 Sat	Private Practice	No	2 receptionist and 2 doctors

Medical Receptionist 3	Case Study 1 Town B	40-50	Female	N/A	4 years	9.00-5.00 Mon -Fri	Hospital	Yes	Hospital staff
Pharmacist 1	Case Study 1 Town B	50-60	Male	40	9.5 years	8.30-5.00 Mon -Fri 8.30-12.00 Sat	Private	Yes	1 pharmacist, 2 assistants
Pharmacist 2	Case Study 1 Town A	50-60	Female	20	3 years	8.30-5.00 Mon -Fri 8.30-12.00 Sat	Private	Yes	1 pharmacist, 2 assistants
Pharmacist 3	Case Study 1 Town C	30-40	Male	15	5 years	8.00-5.30 Mon -Fri 8.30-12.00 Sat	Private	Yes	2 pharmacist, 2 assistants
Pharmacist 4	Case Study 1 Town C	30-40	Female	15	5 years	8.00-5.30 Mon -Fri 8.30-12.00 Sat	Private	Yes	2 pharmacist, 2 assistants
Pharmacist 5	Case Study 1 Town D	30-40	Male	10	2 years	8.30-5.00 Mon -Fri 8.30-12.00 Sat	Private	Yes	1 pharmacist, I assistant
Pharmacist 6	Case Study 1 Town D	30-40	Female	10	1 tear	9.00-5.00 Mon -Fri	Hospital	Yes	1 pharmacist and Hospital Staff
Pharmacist 7	Case Study 2 Town G	30-40	Female	16	18 months	9.00-5.00 Mon-Fri 9.00-12.00 Sat	Private pharmacy	No	1 pharmacist and 2 assistants
Pharmacist 8	Case Study 2 Town F	20-30	Female	3	6 months	8.30-5.30 Mon-Fri 8.30-12.20 Sat	Private pharmacy	No	1 pharmacist and 2 assistants
Pharmacist 9	Case Study 2 Town E	40-50	Female	12	All her life, dad was the pharmacist	8.30-5.00 Mon-Fri 9.00-12.00 Sat	Private/ government model	24/7	1 pharmacist and 2 assistants
Pharmacist 10 Town H	Case Study 3 Town H	30-40	Male	19	5 months, a locum	8.00-6.00 Mon-Sat	1 Pharmacist and 1 assistant	No	1 pharmacist and 1 assistant
Director of Nursing	Case Study 1 Town	50	Female	30	2 weeks	9.00-5.00 Mon -Fri	Hospital	Yes	Hospital Staff
Director of	Case Study 1	50-60	Female	30	20 years	9.00-5.00 Mon -Fri	Hospital	Yes	Hospital Staff

Nursing 2	Town A								
Director of Nursing 3	Case Study 1 Town C	40-50	Female	28	24 years	9.00-5.00 Mon -Fri	Hospital	Yes	1 doctor. 2 RNs, Don
Director of Nursing 4	Case Study 2 Town G	50-60	Female	30	24 years	24/7	Hospital	24/7	1 doctor and 2 RNs a receptionist and DON
Director of Nursing 5	Case Study 2 Town F	50-60	Female	30	2 weeks	24/7	Hospital	24/7	2 doctors. 2 RNs, DON, Allied health providers
Director of Nursing 6 Town H	Case Study 3 Town H	50-60	Female	10	3 years	24-7	Hospital	No	1 GP, NUM DOM, Nurses Receptionists
Nurse Unit Manager 1	Hub community Case Study 2 Case Study 3	30-40	Female	20	11 years	9.00-5.00 Mon-Fri	Hospital	No	10 allied health providers
Nurse Unit Manager2 Town H	Case Study 3 Town H	40-50	Female	25	1.5 years	24-7	Hospital	No	1 GP, 1 NUM DOM, Nurses Receptionists
Nurse Unit Manager 3 Town H	Case Study 3 Town H	50-60	Female	35	5 months	24-7	Hospital	No	1 GP, NUM DOM, Nurses Receptionists
Community Health Nurse 1	Case Study 2 Town D	40-50	Female	25	5 years	9.00-5.00 Mon -Fri	Hospital	No	Hospital staff
Speech Pathologist	Case Study 2 Town D	20-30	Female	8	4 months	9.00-5.00 Mon -Fri	Hospital	No	Hospital staff
Child Health Nurse 1	Case Study 2 Town D	50-60	Female	30	2 years	9.00-5.00 Mon -Fri	Hospital	No	Hospital staff
Child Health Nurse 2	Hub community Case Study 2 Case Study 3	30-40	Female	15	18 months	9.00-5.00 Mon-Fri	Hospital	No	2 child care nurses for whole region
Mental Health Nurse	Case Study 2 Town E	50-60	Male	30	4 years	9.00-5.00 Mon-Fri	Hospital	24/7	1 mental health nurse

Woman's Health Nurse	Hub community Case Study 2 Case Study 3	40-50	Female	16	18 months	9.00-5.00 Mon-Fri	Hospital	No	1 midwife 1 woman's health nurse
Indigenous Health Worker 1	Case study 1 Town D	30-40	Female	15	10 years	9.00-5.00 Mon -Fri	Hospital	No	Hospital staff
Indigenous Health Worker 2	Hub community Case Study 2 Case Study 3	40-50	Female	30	9 months	9.00-5.00 Mon-Fri	Hospital	No	One of 3
Indigenous Health Worker 3	Hub community Case Study 2 Case Study 3	60-70	Male	30	3 years	9.00-5.00 Mon-Fri	Hospital	Yes	One of 3
Indigenous Health Worker 4	Hub community Case Study 2 Case Study 3	20-30	Female	0	6 months	9.00-5.00 Mon-Fri	Hospital	No	One of 3